THE HANDYMAN IN THE HOME

EDITED BY

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Late Editor of "Mechanics"

Assisted by

SEVERAL EXPERTS

VOLUME I

THE CAXTON PUBLISHING COMPANY LIMITED

MORLEY HALL, ST. GEORGE STREET, HANOVER SQUARE

LONDON, W.1

First Edition . . . . June 1923
Reprinted . . . . November 1930

PREFACE

As its title indicates, this work has been prepared expressly for the practical handyman desirous of undertaking a wide variety of jobs connected with the home, garden, garage and small workshop, including not only the domestic repairs and renovations that become necessary from time to time but also useful improvements and additions to the home and its contents.

The keen home dweller, with a knowledge of the use of the simple tools and materials described in these volumes, can not only tackle most household repairs and additions expeditiously, but also avoid a good deal of expense. Apart from these considerations, there is always the satisfaction associated with the completion of a job that would otherwise have meant calling in someone else for the purpose.

In addition to the extensive range of household repairs, fittings, furniture and other relevant items dealt with in this work, there are also a number of sections, including those on homecrafts, hobbies, sports accessories, outdoor constructions, etc., which will be found both useful and profitable to the handyman and housewife. Since many of the articles in these volumes deal with woodwork repairs and new constructions, it was considered desirable to include a comprehensive section, written by a well-known expert in such matters, on the subject of carpentry and woodworking tools, so that the reader who is not very well acquainted with the use of the latter can improve both his knowledge and experience.

Because of this modern electrical age, when every household is fitted with numerous domestic electrical appliances, a good deal of practical information has been included, for the benefit of the householder desirous of doing minor electrical repairs and installations, in connection with electric lighting and heating. In order to make the electrical section of this work as complete as possible, the subjects of wireless-receiver maintenance and installation and television installation have been included; batteries and battery charging are also dealt with.

In connection with the general maintenance of the home, painting, papering and distempering are of primary importance. It is for this reason that a good deal of practical information on the subjects of paints, distempers, brushes, interior and exterior house painting, wall and ceiling distempering and papering, furniture painting, etc., has been included. The home handyman can thus undertake many of these relatively expen-

sive tasks and, by following the practical notes and instructions given, be assured of thoroughly satisfactory results. In these days when a large proportion of house occupiers own cycles, motor cycles or motor cars, it is a big advantage to know how to maintain, and do light repairs on, these vehicles. Those interested in such matters will find a considerable amount of practical information, supplemented by explanatory illustrations, in Vol. III, Section 1, of this work.

Mention should also be made of the very large number of recipes of all kinds that have been included; these cover a wide range of domestic requirements, and are inexpensive to prepare.

In planning this work it was considered desirable to include the subject of concrete and its applications in domestic and garden work. In this connection the selection of the materials, their apportioning and mixing for different applications of concrete are dealt with in detail and a number of useful constructions which can be undertaken by the home handyman are described; these include domestic flooring, crazy paving, garden seat, concrete tiles and paths, a garden roller, bird bath, steps, bricks, concrete wells and walls.

Homecrafts which appeal either as hobbies or for profitable reasons, which are dealt with in some detail in the appropriate section, include barbola work, basketry, beadwork, cane seating, decoration with coloured paper, stencilling, picture restoring, tablet weaving, leatherwork, papier mâché, and many other attractive crafts.

Two sections of this work which should have a strong appeal to the housewife are those entitled "Make do and Mend," and "First Aid in the Home"; these articles are particularly well illustrated, and they contain a large amount of practical information of a particularly useful nature.

In the preceding remarks concerning the scope of this work it has been possible to select only a few representative items from the relatively large number included, but it is hoped that these will afford some general idea of the range of subjects that is covered in these volumes.

In conclusion, we should like to express our appreciation of the valuable assistance that has been given by a number of experts in the preparation of certain sections of this work. In particular to Messrs. F. E. Dean, H. H. Jones, and W. J. Ellson; also to Messrs. Dryad Ltd., Samuel Jones and Co. Ltd., The Rawlplug Co. Ltd., and Raleigh Industries Ltd.

A. W. JUDGE.

Farnham, Surrey.

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Volume I

SECTION 1

BUILDING

CESSPOOL CONSTRUCTION

The construction of a cesspool is not outside the powers of an amateur, but it must be borne in mind that plans must be submitted to the local authority before commencing the work.

A suitable tank 5 ft. by 3 ft. 6 in. by 5 ft. deep inside is shown in Fig. A.

The tank proposed has a 6 in. deep concrete bottom upon which 9 in. brick walls are built and roofed over with a 6 in. thick concrete top, having the necessary holes for access for cleaning and ventilation. A concrete baffle is arranged on the angle in close proximity to the outlet, and after the inlet and outlet tee pieces have been built into place, the inside of the tank is rendered smoothly with cement, good large fillets being made in all corners to prevent the lodgment of sewage and to simplify cleansing.

The vent over the inlet tee piece is shown with a perforated iron plate flush with top of tank, but if placed in a field, where liable to be overgrown with grass or trodden over by cattle, it is usual to raise a square brick flue here about 2 ft. high, with a grating let into the side. If outflow from tank is to be run into a field pit, this should be about 20 ft. away, and may consist of a hole 6 ft. diameter, or larger, by about 6 ft. deep, filled in with broken brick, stones, or clinkers, and turfed over.

The Pipe Line.—With regard to the pipe line, consisting of 4 in. pipes, these should be of the best vitrified quality, with spigot and faucet, and are to be had in lengths of 3 ft. and under. Bends should be avoided, but, if necessary, should have inspection doors, as shown in Fig. B. Should the pipe line be straight, at least two pipes should have inspection doors to facilitate the passage of a cane in event of a chokage. A run of at least one in forty should be allowed, if possible, although one in sixty will do provided the pipes are well laid. In laying the pipes, both spigot and faucet should be wetted, and a good ring of cement being put on the spigot end this should be pushed well into the faucet and centralised, when the faucet may be finally filled in and finished off smoothly outside, any excess cement inside the pipe being removed with the aid of a half-round scraper. Some drainlayers use clay to start the joint, and finish with

cement, the idea being that any clay protruding into the pipe will get washed away later, but this is bad practice, as once the clay is washed out of the joint a lodgment is made for sewage, which is undesirable. New cement or lias lime must not be used for joints, as they expand and burst the sockets. All cement used must be well ground and used neat. The soil pipe should be 3½ in. diameter C.I., and should be extended up to the roof and capped with a wire cage, the bottom end terminating in a fireclay

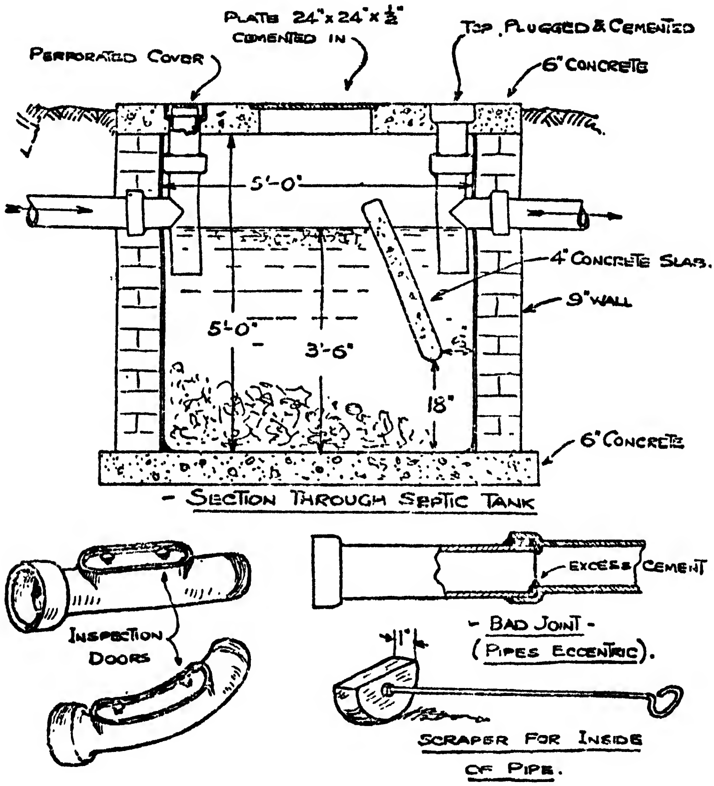


Fig. A.—Details of Septic Tank and Pipes.

bend, having the necessary branches for rain-water, etc. All drains must be outside, wash basins, sinks, and baths should be separately trapped, and an extra grease trap provided outside for scullery or wash-house water.

CESSPOOLS

Where there is no danger of the sewage polluting the water supply, and the ground being constituted of chalk or gravel, the cesspool may be built circular. The blocks of stone of irregular shape are built so as to form a perforation through which the excreta and waste water from the house are allowed to percolate. At intervals it may be necessary to stir up the sewage by means of a vertical shaft through the cover and operated by a

wheel on top, such shaft having crossbars to assist the breaking up of the excreta, thus enabling the waste matter to escape more freely. This form may be perfectly hygienic when used for a small house and situated about 100 ft. away from the house. It may also be used in conjunction with a catch pit, only to be used by diverting the flow of sewage into it while possible remaining excreta is allowed to solidify so that it may be dug out. There is always an element of danger from gases, which form from decomposed matter, to those who may have to enter these cesspools, so that it should be an injunction to have the atmosphere of it tested before doing so. A suitable size would be of 6 ft. by 9 ft. with very little means of escape for the excreta, which is dug out. Footrests are built projecting

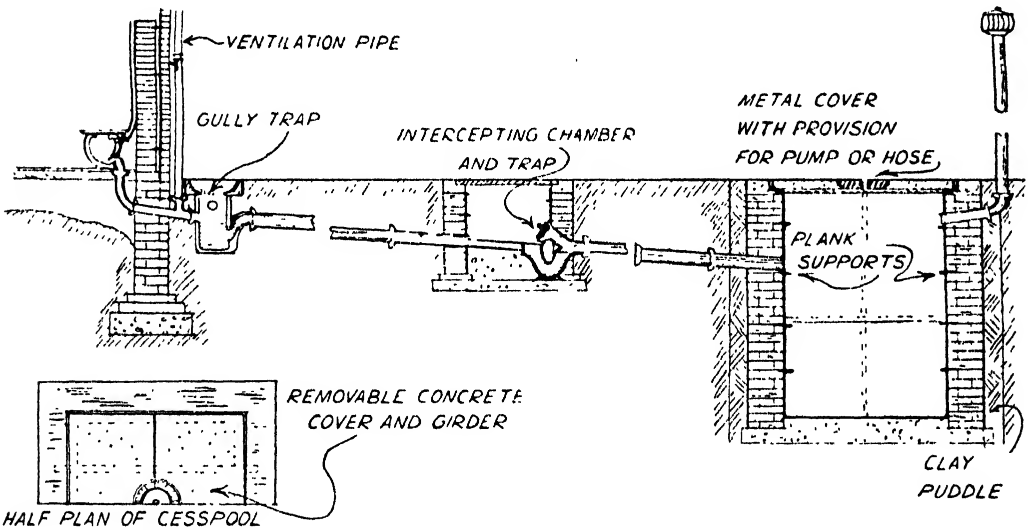


Fig. B.—House Drainage System with Cesspool. (Lower left). Half Plan showing Concrete Cover in Sections for Easy Removal.

about 3 in. from the wall; on these, broad planks are placed for the men to stand while engaged in digging the excreta out.

Use of Leaves.—It is well known that in other countries leaves from the forests are gathered and mixed with the excreta; this is done by means of a three-toed steel drag with a long handle, and used by working it backwards and forwards while the leaves are being scattered over it. Allowed to solidify, it is dug out, dried, and sometimes ground down to be sold as a patent manure.

Other Methods.—Another method consists of raising it by long-handled scoops and placing it in tank carts by which it may be conveyed to arable land, covered with a layer of soil, and where, by the aid of the dry elements, and the addition of lime, purification is hastened, but this method is only adopted when the matter is more or less in liquid form. Suction pumps

with a 2 in. flexible hose through the cover of the cesspool are sometimes used. These suck up the fluid matter, which is conveyed into tanks for distribution over the land. Other forms of cesspools are mainly of brick or concrete; one may be of circular form with domed top of concrete and also the floor of concrete, the whole being rendered throughout with a waterproof mixture of cement in one part and sand two parts. One of the latter type would be quite suitable for a house whose supply consists of that from a lavatory, bath, wash up, and scullery sink.

Intercepting Chamber.—Provision must be made for an intercepting chamber, which should be built between the house and the cesspool, whether circular or square; this receives the drain pipes from the house, and passes them on through an interceptor trap which has a cleaning eye with tight-fitting cover. In the chamber half-pipes are used for inspection purposes. Ventilation of the cesspool is provided by means of a ventilating pipe which may be carried up a stout post or even a tree would suit the purpose.

Overflows.—Overflows when allowed are placed a little lower than the drain-pipe inlet from the house, when by means of a series of branched-off field drain pipes the waste matter is carried on to prepared land or better still on to a filter bed.

It may be quite possible that by adopting the old-time well windlass as used for drawing water, and by means of the more modern grab bucket, the solid matter—but it must be allowed to become solidified—could easily be gripped, when the bucket would close up upon being hauled up. This would be applicable to those cesspools which have a heavy timber or concrete lid with full bearing upon the walls.

CHIMNEY STACKS AND REPAIRS

Chimneys are enclosed flues, built of incombustible material, and are designed to encourage such currents of air as are essential for the proper combustion of the fuel in the fireplace below, as well as a means of carrying away the waste fumes of combustion, and discharging them high enough to avoid becoming a nuisance, and for this purpose the stack, built through the ridge, should be at least 3 ft. above.

Flues.—Flues are usually 9 in. by 9 in., though those from kitchens may be 14 in. by 9 in., and in order to retain the heat so essential to making the draught more regular, the linings of the flues are pargetted, the term used to signify coating the brick surface with a layer of prepared lime mortar. The waste products of combustion are offered less resistance from flues so treated, and the risk of fire or smoke penetrating adjoining flues is minimised.

Stacks.—Stacks are usually built of 4½ in. brickwork throughout, though for heat retaining 9 in. brickwork for the outside walls is preferable, also at least the oversailing courses of the capping should be built with cement mortar (Fig. A).

Flue Linings.—The use of flue linings of fireclay to flues is an advantage in this respect, since besides being of a somewhat smooth surface, and by virtue of their being built solidly into position, they act as heat retainers. Flue linings may be obtained to fulfil various purposes, chief among them being those to accommodate inclined flue angles

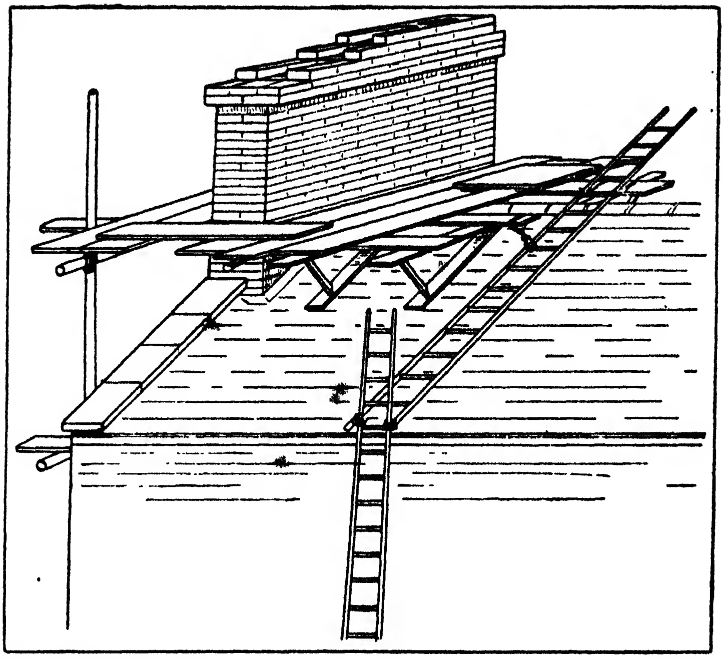


Fig. A.—Method of constructing a Scaffold when Chimney Stack is on Gable.

such as rectangular and round bends to such linings as are rectangular or circular.

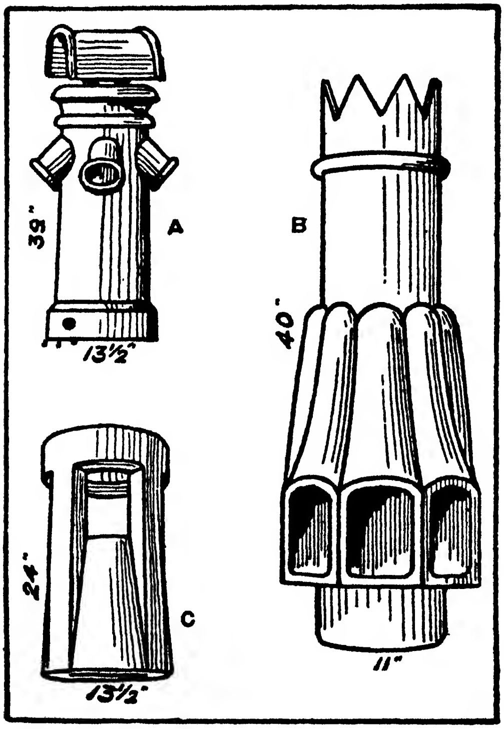


Fig. B.—Chimney Pots. Downdraught Preventers. A.—Buff-colour Pot. B.—Salt-glazed or red colour. C.—Buff, red or salt-glazed.

Chimney Pots.—The design of the chimney pot should be influenced by that of the chimney and its capping as regards shape, colour, and proportion, though modifications are made to combine those with that of preventive downdraught, as A (Fig. B), buff colour; B, salt-glazed or terra-cotta; and C, buff, salt-glazed or terra-cotta.

Downdraught.—The close proximity of the dwelling with that of other higher buildings and trees is a frequent cause of downdraught, while other existing causes are: too wide an opening at the base, lack of ventilation in the rooms through tightly fitting closed doors and windows. The

methods adopted to overcome downdraught are legion, and while some have proved invaluable to their particular sphere, none may be said to be universal cures. The usual means adopted with pots are as shown at A, B, and C (Fig. B). The essential bricklayer's tools for chimneys are illustrated in Fig. C.

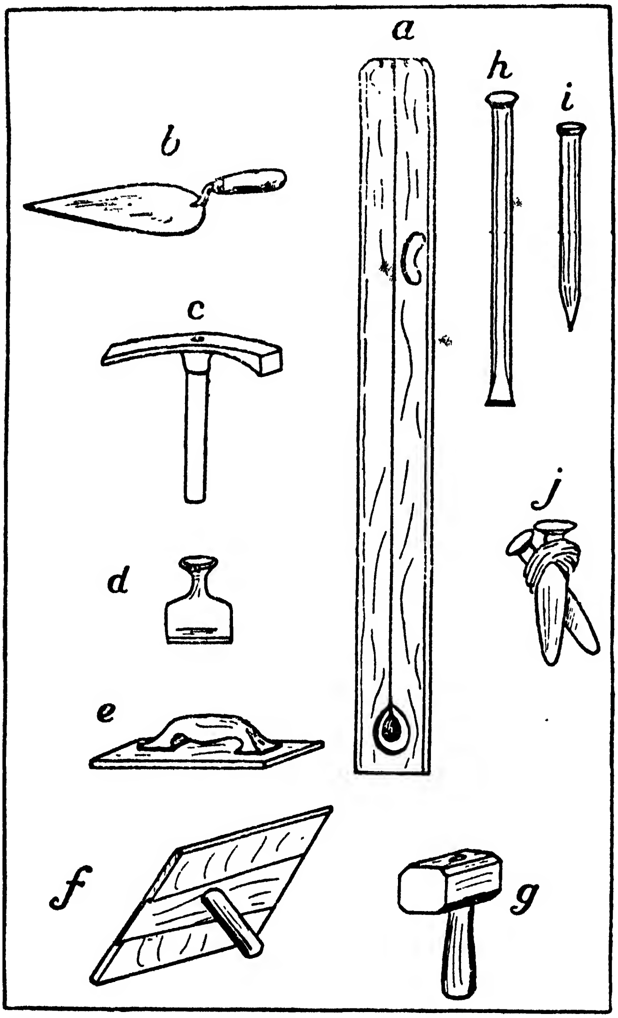


Fig. C.—Bricklayer's Tools for Chimneys, etc. *a.*—Plumb Rule and Bob. *b.*—Bricklayer's Trowel. *c.*—Bricklayer's Hammer. *d.*—Nicker used to cut Dense Bricks. *e.*—Wood Hand Float used to smoothen Mortar. *f.*—Handboard. *g.*—Mash Hammer. *h.*—Steel Drill. *i.*—Steel Point. *j.*—Line and Pins.

Cowls.—There are numerous designs of revolving zinc cowls, fitted with grease cups and ball bearings, also sheet galvanised metal chimneys of several feet in height, and in the form of H and Y. Other methods adopted are the insertion of 2½ in. pieces of piping into the stack in an inclined position with the roof, the special construction of smoke and soot pockets in the flue at the first bend downwards, and the use of perforated grids with patent flaps, and also extension pieces fixed to existing fireplace hoods. The sweeping of flues is made rather a difficult task with these devices. There should be provision for soot-cleaning iron doors at inclined flue angles, and the use of chemicals and "bombs."

Repairs.—Extensive repairs to stacks necessitate the use of trestles laid upon the roof and secured by ropes over the ridge upon which planks are placed to work upon. To point the joint: hack out the joint, then dust out and wash down, and point with a mortar composed of four parts haired mortar to one part of Portland cement, the new mortar being weathered downwards to the bottom edge. To fix a pot providing that the top courses are sound, place pieces of slate

angularly across the flue, place the pot in position clear of the slate edges, then, after alternative coats of mortar and brick, the top is flashed up alone with a cement and sand mixture. Cowls are wired to the pots.

DAMP WALLS, TO REMEDY

Dampness in walls is attributable sometimes to the bricks, sometimes to the plaster, imperfect damp-courses, lack of ventilation, etc. For example, if the outer wall be constructed of soft, absorbent bricks and the wall ties not of a proper shape, or irregularly built, it is possible for rain-water to percolate to the inner casing, hence the discoloured parts or patches are the results.

One cause of dampness is the absence of a damp-course or one placed too low so that garden earth bridges it. A faulty damp-course is another cause; another (Fig. A) is the accumulation of mortar or a piece of brick left in the cavity wall during building. Leaky spouting or downflow pipes are other causes. Even a cistern overflow if it runs on to the wall continuously will result in dampness. Defective window frames and sills and defects in mortar in brick joints are other likely causes of damp walls that must first be looked for, before attempting to cure the trouble with wall preparations (Figs. B and C).

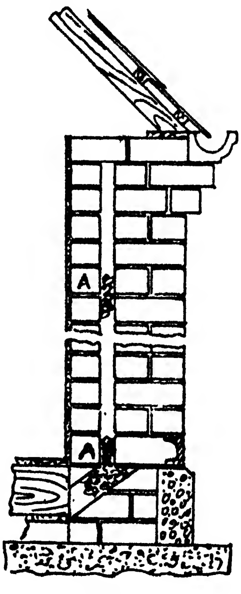


FIG. A

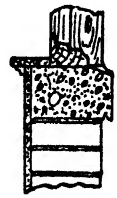


FIG. B

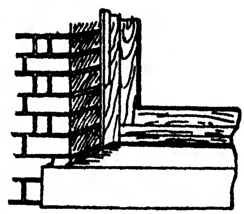


FIG. C

Fig. A.—Cavity Wall showing, at A, dislodged Mortar debris on Wall Tie and Bottom—blocking Air Vent to Floor.

Fig. B.—A Porous Concrete Sill or one not properly Pointed may cause interior Dampness.

Fig. C.—Window Frame and Brick showing how lack of Pointing can afford an entry to Water.

One other likely reason that should be mentioned is that due to defective roof-water spouting or spouting or downpipes stopped up with leaves. The water from the roof will then overflow and run down the walls, in many instances. Defective slates on the roof are yet another cause of wall dampness.

The following preparation, however, may be used with advantage on the plaster which is to be afterwards papered or painted. Procure 3½ lb. zinc white paste paint, 7 lb. pale resin, 1 pint oak varnish, 3 quarts coal-tar naphtha, and 1 quart boiled linseed oil. Melt the resin in an old iron receptacle over a fire, add the boiled oil and varnish, and stir well together. Remove the mixture from the fire, and allow it to cool to about 100° F., then add 5½ pints of naphtha while stirring. In another receptacle mix the zinc paint with ½ pint of naphtha; then thin down

with the above mixture. Care must be taken in mixing the naphtha well away from any fire or light, as it gives off an inflammable vapour. The above preparation dries with a hard enamel-like surface in about six hours, or if applied warm, in three hours.

Another remedy is to apply two coats of solution made by dissolving 2½ lb. orange shellac and ¼ lb. common resin in 1 gallon methylated spirit, and after this is perfectly dry the plaster may be papered. There are many so-called remedies for treating damp walls, but it is advisable, in the first instance, to take every precaution to avoid dampness.

Some alternative recipes are given below.

In order to get the walls sufficiently dry to receive special paints, the writer placed a large open stove in the middle of the room and kept it burning night and day; this partially dried the walls on the surface, but when specialities were applied they were all found to be useless. In desperation he had all the plaster hacked off and re-rendered in Portland cement and very little sand; once this cement is hard the water will not penetrate it. The job was successful. For plain stucco or sand-dash the work should be rendered ¾ in. thick in two coats, the cement being made of 3 parts of coarse wash sand, 1 part cement, and 3 lb. of Pudlo to every 100 lb. of cement. For exposed situations 2 parts sand, 1 of cement, and 5 lb. Pudlo are used.

Exterior Treatment of Walls with Pudlo.—Weather-beaten walls may be rendered in stucco or sand-dash, to a thickness of ¾ in., applied in two coats, as follows :

Three parts of washed sand, 1 part of Portland cement, 3 lb. of waterproofing powder to every 100 lb. of cement. For very exposed situations : 2 parts of washed sand, 1 part of Portland cement, 5 lb. of waterproofing powder to every 100 lb. of cement.

Stone and Pebble Dash.—Render ¾ in. in two coats, the first coat only to contain the waterproofer and to be ⅜ in. thick : 3 parts of washed sand, 1 part of Portland cement, 5 lb. of waterproofing powder to every 100 lb. of cement. For very exposed situations it is necessary to use : 2 parts of washed sand, 1 part of Portland cement, 5 lb. of waterproofing powder to every 100 lb. of cement.

The following is another method :

The walls must be well cleaned before painting. If the plaster should be worn and permeated with saltpetre in places, it should be removed and smoothed. The clean surfaces are coated twice with a water-glass solution, using a brush, and allowed to dry well. Then they are painted three times with the following mixture :

Dissolve 10 parts, by weight, of mastic in $\frac{1}{10}$ part of methylated spirit, pour 100 parts of water over 20 parts isinglass, allow to soak for six hours. Heat the solution and add 10 parts methylated spirit. Into this mixture put a hot solution of 5 parts ammonia into 25 parts methylated spirit, stir well, and subsequently add the mastic solution and stand aside warm, stirring diligently. After five minutes take away

from the fire and painting may be commenced. Before a fresh applica tion, however, the solution should be removed. When this coating has dried completely it is covered with oil or varnish paint, preferably the latter. In the same manner the exudation of so-called saltpetre in fresh masonry may be prevented, size paint or lime paint being employed instead of the oil or varnish paint. New walls which are to be painted will give off no more saltpetre after two or three applications of isinglass solution, so that the colours of the wall-paper will not be injured either. Stains caused by smoke, soot, etc., on ceilings of rooms which are difficult to cover up with size paint may also be completely isolated by applying warm isinglass solution two or three times. The size paint is, of course, put on only after the complete drying of the ceilings.

There are several other preparations used to seal damp walls after they have dried out. Typical proprietary ones that have been tried out include: Synthaprufe, Ironite, Dampro, Rito, Prufitol, etc. These are usually in the pasty or liquid form and full directions are enclosed for their correct application.

Another bituminous preparation is that known as Bituplastic.

A dried-out damp wall can be damp-proofed externally by first digging away the earth so as to expose as much as possible of the lower wall surface and brushing all earth away from same. Allow the wall to dry off thoroughly and then apply a coating of warm coal tar or one of the cold preparations, such as Colas. Thick mineral oil such as used crank-case oil can also be used to waterproof brickwork, but it is not so effective as the tar preparations.

Several coatings of water-glass solution, followed by a coat of oil paint, will also give an excellent waterproof surface.

(See also "Cellars, To Cure Damp.")

Waterproofing and Colouring.—Damp walls may be waterproofed and coloured, but should grime be present upon the brickwork it should be washed down with a soft-soap solution containing a few drops of ammonia, followed by a clear-water wash, as the grime would intermix with the colour solution and become hideous.

Copperas is a powerful staining agent, mixed with a small quantity of limewash. The brickwork should be brushed well over and into every pore. The green copperas as used is dissolved in water and added according to desired tint of yellow.

When dry, brush over with a silicate of soda solution, 1 part to 6 parts water, in two or more applications, according to state of dampness.

Other methods of colouring yellow are as follows:

(1) Make limewash as usual and when cold add 1 gallon silicate of soda solution (1 to 4 parts) to 30 gallons limewash, stir well and add yellow ochre according to colour desired.

(2) Amalgamate 1 pint of boiled linseed oil with ½ lb. of Russian tallow. Boil 3 gallons of water and add the tallow and oil mixture. Then add, say, 3 lb. of copperas; a little whiting added will correct the yellowness if necessary. Thorough mixing is essential.

DRYING OUT A NEW HOUSE

Conditions which are Against It.—An inspection of many houses built during the latter years has revealed a very unsatisfactory state of affairs. The demand has been such that houses have been built here and there upon waterlogged sites, and without adequate damp-courses. A damp-course of a kind may have been inserted, but not of a quality or in the right position to prevent the joists and flooring from rotting, necessitating the renewal of such floors within a matter of nine months after. In addition to this these houses in question may not have had a sufficiency of air bricks, for it is imperative that air bricks should be placed at about every 8 feet in the 4½ in. brick face of the cavity wall, and positioned below the joist so that a continuous current of air should pass through.

Use of Air Bricks.—Air bricks also should be placed at the top of the cavity to encourage ventilation between the walls all round the building. A waterproofed concrete raft would have cured the evil, at the first, but as a rule there is so little space between the joist and the earth that that way of trying a cure is cut off. One may have been called in to inspect such a house and would probably find that perhaps a linoleum cover or even a new carpet laid upon stiff paper would be laid, and that too tight up against the skirting board. This is all wrong; far better to have mats placed at intervals, because a certain amount of ventilation is derived from under the skirting and the short floorboard ends. Mortar droppings at the bottom of the cavity in the wall, allowed to accumulate during the construction of the house, may have blocked up some air bricks. It has also been found that in the desire to put the garden in order, air bricks have been found covered up with earth.

Introducing Ventilation.—An induced ventilation has been formed by boring holes through the riser of the step, and in addition, by cutting out a portion of the first floorboard within the step and fixing in its place a perforated metal grid. This rather savours of the curing of dampness arising from defective construction, still, nevertheless, while such conditions remain, dwellings even with fires burning in the grates could never become dry enough for habitation. Another means of sustained dampness and the discoloration of distempered and wall-papered surfaces is the building in of old and contaminated bricks. In many districts, owing to the scarcity of bricks and also to economise, old factory disused bricks were introduced into house-building schemes, with the result that, owing to foreign matter upon them, great patches occurred here and there upon the plastering which collected and retained the moisture in the room. Bricks have been removed from the walls and examined under the microscope, and also chemically tested, to prove this assertion. The desire to have such houses fully decorated before occupation has resulted in tradesmen having to go in, cut off the affected plastering, chip off the face of the bricks, and renew the plastering, but with a waterproofed

cement and sand mixture and finished with Keene's cement when hard enough.

Using the Fireplaces.—Following the finish of the plastering of a new house and even when other workmen were still busy, fires would be burning where immediate occupation was desired—paying due regard to the keeping of the windows open sufficient to prevent condensation after the fires were allowed to die out. During the summer months the plastering would probably dry too quickly, resulting in cracked surfaces and probably pined and warped timbers and doors, though the brickwork even now would be damp. At certain periods excessive moisture in the rooms, and especially as the wet season approached, would cause these damp patches to occur. In the winter months the process is a longer one, necessitating the employment of portable heaters in the rooms as well as fires in the grates, advantage being taken of drying winds to have the windows open.

Effect of Frost.—Frost plays an important part too in drying, for often there is no moisture left when a change comes. Under the best of conditions it takes about a year or even more for a house to dry out. Also filling up the pores of plastering with distempers does not in any way help matters so far as assisting the walls to dry out is concerned.

FIXING DEVICES FOR HEAVIER OBJECTS

The flexible type of metal plug, made of lead or lead alloy, is particularly suitable for use in brick or concrete walls, where heavier loads have to be carried. Typical plugs based on this principle are the Metlex and Rawlplug screw anchor. The former consists of a kind of lead scroll of tubular shape, which is inserted into the hole made by the wall drill. The Rawlplug device, shown in Fig. A, resembles a hollow countersunk rivet, but it is split in certain places to enable it to expand outwards under the action of the screw. The bore is tapered to permit a greater expansion at the bottom of the hole. The countersunk and bored entrance enables the woodscrew to commence cutting a thread as soon as it enters. External fins on the shank prevent the plug from rotating whilst the woodscrew is being screwed in. As this type of plug is not resilient like the fibre one, it affords a solid non-yielding grip to the screw, of a permanent nature, and, as previously stated, it will sustain relatively heavy loads.

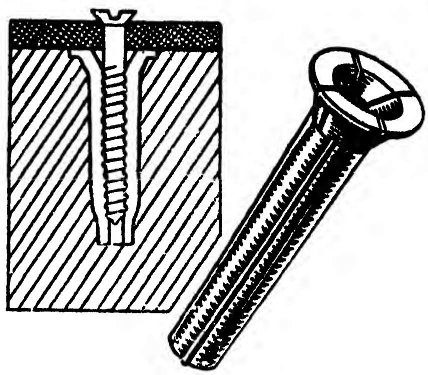


Fig. A.—The Rawlplug Meta Fixing Plug.

For making the holes in brick, concrete or stone, the percussion type of tool illustrated in Fig. A (1), page 27, can be used, provided that it is rotated continuously whilst being struck by the hammer. A better method

in many applications is to use an extremely hard pointed twist drill made for the purpose. It has a special shape of point for its purpose and a square shank made to fit a carpenter's brace. This drill will readily cut into brick and concrete.

For applications where many holes have to be made in walls, as routine procedure the hand operated mechanical hammer (Fig. B) is recommended. This not only provides a regular series of hammer blows when the handle is rotated, but rotates the percussion drill. It gives 480 blows per minute when the handle turns at its designed speed of 120 revs. per minute.

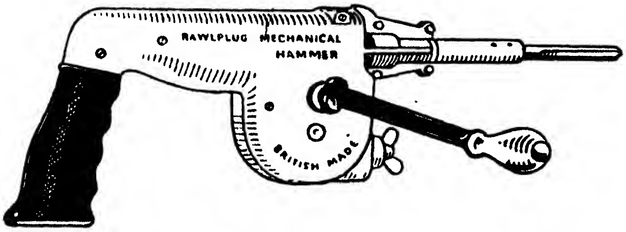


Fig. B.—Mechanical Hammer for making Holes in Walls.

There is also an electric Rawlplug hammer for the same purpose, operating off D.C. or A.C. mains supply.

For the heaviest applications, such as the fixing of machinery or heavy domestic machines, furniture, etc., to walls, or for holding machines down on concrete floors, the well-known ragbolt is used, but more recently this has been superseded by specially designed bolts with expanding nuts which grip the sides of their cylindrically drilled holes in the wall or floor. The Rawlbolt, Fig. C, and anchor bolt, Fig. D, are typical examples of efficient

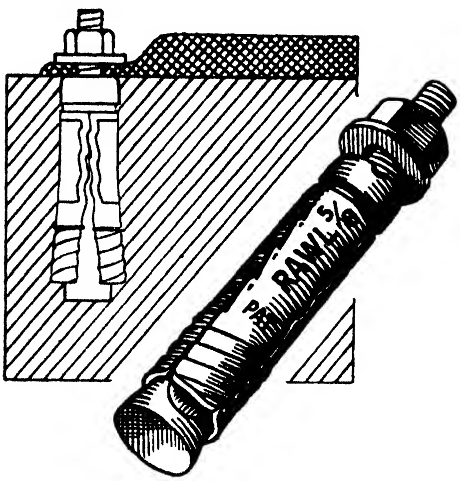


Fig. C.—Rawlbolt used for fixing Heavy Objects, such as Machinery.

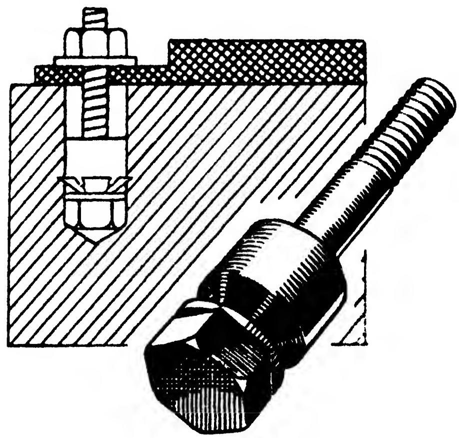


Fig. D.—Another Type of Rawlplug Anchor Bolt.

devices of the heavy fixing pattern. They are simple to use since, after the hole has been made the device is pressed into the hole; the fixture to be held is then positioned over the stud portion of the device, the washer and nut inserted and the nut tightened up. The expansion member then opens outwards to grip the sides of the hole very securely.

A Wall-plug Tip.—When fixing wood or any of the patent wall plugs into position, if the hole has accidentally been made too large for the plug to obtain a good fit, smear the outside of the plug well with plastic wood or Portland-cement paste before inserting. Allow it to harden before inserting the screw.

Woodscrews and screw hooks, etc., can also be fixed into walls by first boring a hole equal in diameter to about two diameters of the screw portion and then filling either with plastic wood or stiff cement mixture. Support the screw in its proper position until the material has set hard. A mixture of gum and plaster-of-paris is a good alternative filler for the hole.

GARAGE IN CONCRETE

The following account describes in detail the preparation of the site and the construction of the simple design[1] of garage illustrated herewith. The operations are given in their correct order of execution.

The garage shown contains 2,440 cubic feet, and would not be costly if the labour is free, e.g., by the owner.

Generally.—Provide all tools, tackle, materials, labour, etc., necessary for the proper carrying out and completion of the design to the true intent and meaning of the drawings.

Clear away all dirt, rubbish and superfluous materials and leave all clean and perfect on completion. Maintain the contract for four months after the final completion of the works.

Special Works.—Remove the surface soil and deposit on site where directed.

Excavate for foundations to the depths and widths required. Fill in round foundations as required.

The cement to be British Portland Cement of approved manufacture to comply with the requirements of the British Engineering Standards Committee.

Aggregate for stone concrete to be of hard brick or stone to pass through a 1½ in. sieve.

Aggregate for breeze concrete to be good hard clinker breeze to pass through a ¾ in. sieve and free from sulphur and all other impurities.

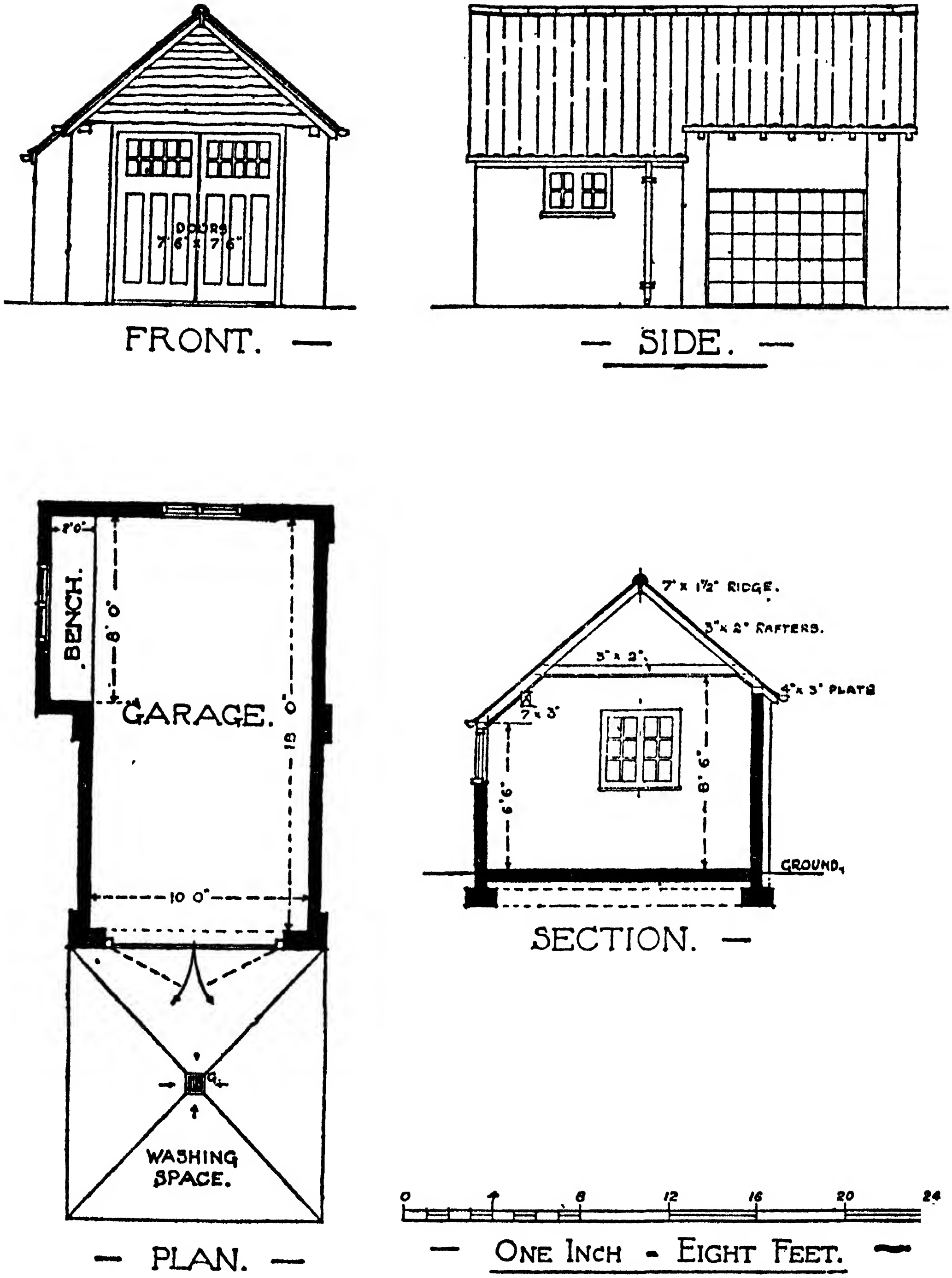
Gravel to be clean sharp river or pit gravel.

Sand to be clean, hard, sharp river or pit sand free from loam and washed if required.

Concrete in foundations and under floors and washing space to be stone concrete mixed 6 parts aggregate, 2 parts sand to 1 part Portland cement.

The surface concrete 6 in. thick to be laid to falls and floated off smooth to receive 1 in. granolithic cement finish composed of 3 parts granite chips to 1 part cement.

[1] By Douglas Wood, F.R.I.B.A. (Courtesy British Portland Cement Association.)



An Attractive Garage in Concrete.

Provide a slate damp-course 2 slates thick in cement with breaking joints.

The walls above damp-course to be constructed of concrete blocks 18 in. long by 9 in. high by 6 in. thick, or breeze concrete jointed in cement and properly bounded together with piers and buttresses.

Render the external surfaces with 1 coat of white cement and washed sand mixed 1 to 2 and finish ½ in. thick. The surface to be reeded and moulded as shown on the drawings.

The panels of parapet walls to be filled in with half-round red Italian tiles pointed in cement.

The Roof and Eaves.—Frame the roof with 4 in. by 3 in. plates, with 3 in. or 4 in. by 2 in. rafters spaced 14 in. apart in clear, 3 in. or 4 in. by 2 in. collars, and 7 in. by 1¼ in. ridge, as shown on drawing.

The eaves to be open eaves with rafter feet treated with wood preservative, and cover roof with approved asbestos cement pantiles, red colour, laid in accordance with the makers' instructions on 1¼ in. by ¾ in. tile battens.

Cover ridge with half-round red ridge tiles in cement.

Fill in gable ends with 1 in. elm boarding, securely nailed to 3 in. by 2 in. framing.

The Windows.—The windows to be 1¾ in. deal rebated and moulded casements hung to 4 in. by 2 in. frames and mullions with ½ in. stops planted on and 6 in. by 3 in. oak weathered and throated cills.

The Doors.—The doors to be 2 in. deal double hung type with 4 in. by 2 in. jambs and heads, 7 in. by 2 in. rails and 3 in. by 2 in. uprights. The upper panels to be cut into small squares for glazing with 1 in. moulded and rebated glazing bars.

Hang doors with 2 pairs of approved hinges—24 in. long, p.c. 8*s*. per pair, to 6 in. by 4 in. rebated and rounded frames with galvanised iron dowels to concrete sills.

Frame and fix 1¼ in. deal bench on proper bracket supports where shown. Provide and fix 4½ in. approved asbestos cement gutters, and 3 in. diameter downpipes fixed in accordance with maker's instructions.

Finish walls externally with ¾ in. cement stucco (3 to 1), applied in two coats, the finishing coat to be composed of 1 part white cement to 2 parts clean washed sand and left rough from a wood float.

The walls internally to be pointed in cement. Round off the angles of concrete floor to walls with 2 in. radius.

The Ceiling.—Lath and plaster the ceiling of garage internally.

Where trellis is shown on walls fix 1 in. by ½ in. deal battens vertically and 1 in. by ½ in. battens horizontally with 2 in. by 1 in. splayed capping, all nailed together and plugged to walls at intervals. Treat with one coat of wood preservative before fixing.

Provide a 4 in. galvanised two-lever rim dead lock to garage doors and No. 2 9 in. W.I. barrel bolts.

Provide malleable iron stays and fasteners to windows. Glaze windows and doors with 15 oz. sheet clear glass.

Paint wood and ironwork usually painted, with two coats oil colour in addition to priming.

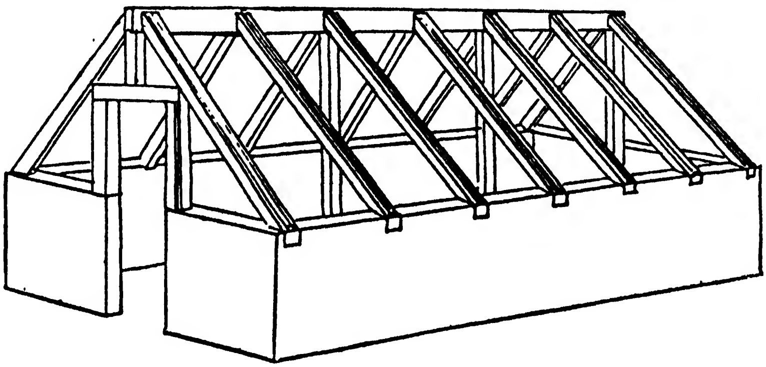
Provide and fix deep 6 in. diameter gully pot and galvanised iron grid to floor and connect to drain.

Leave all clean and perfect on completion.

GREENHOUSE, IN CONCRETE

The greenhouse shown in the accompanying drawing may be constructed in concrete.

The walls are 6 in. thick, and 3 ft. to 4 ft. above ground. The foundations are 1 ft. 6 in. deep by 1 ft. wide. A mixture of 1 part Portland



A Greenhouse in Concrete.

cement, 2 parts clean sand, and 4 parts broken stone or shingle from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. diameter is recommended for the walls, and 1 : 3 : 6 for the foundations.

The upper framework is of wood, but alternatively can be made of reinforced concrete.

Tests have shown that the addition of suitable colouring material does not affect the strength or durability of concrete, so that if desired the greenhouse might be given a tint suitable to its surroundings.

MAGNESITE COMPOSITION FLOORING

This type of flooring can be laid down by the amateur. It can be coloured, as shown below, to any desired shade.

The magnesium chloride is supplied in a sheet-iron drum of about 2 cwt., and the calcined magnesia in bags of 2 cwt. As one drum of chloride, two bags of magnesia, and two bags of sifted fine sawdust will cover 25 yards at a thickness of $\frac{5}{8}$ in., it is suggested to lay it at that thickness and not at $\frac{3}{4}$ in.

Red- -oxide of iron; black—lampblack; grey—lampblack and man-

ganese dioxide; brown—brown roasted iron oxide and brown ochre; blue—ultramarine; violet—violet oxide of iron. These are the colours most suitable for colouring the magnesite compost, of which about 5 lb. will be required.

ROOFS AND ROOFING

Slate Roofs are the most economical in that besides requiring lighter roof timbers the slates are more easily replaced when broken; they are very durable and are bad conductors of heat. The slates are nailed to slate laths (battens) of about $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. in thickness, the laths being nailed to the common rafters. The nails used to secure the slates are usually zinc or composition, though copper nails are often used. With this form of roofing the slates are pointed (torched) on the under side with haired lime mortar; in common work the joints of the slates and the batten edges only are pointed, but for better-class work the whole under surface is so treated. Ridge tiles are also bedded with haired mortar, but with an addition of a one-sixth portion of Portland cement, the pointing of the joints being usually coloured with ground ashes or a little lampblack. Typical examples of tile ridges and finials are shown in Fig. A.

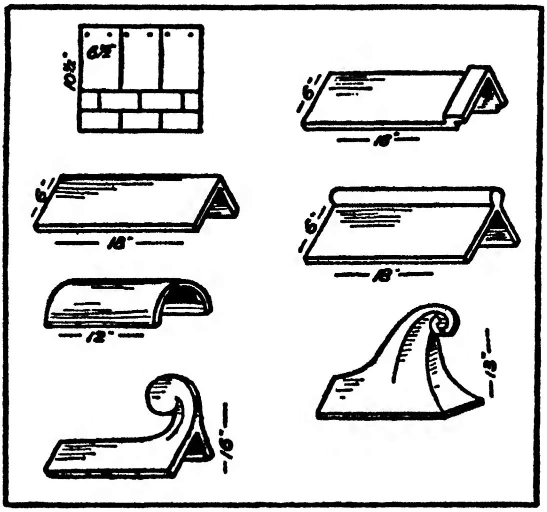


Fig. A.—Tiles, Ridges, and Finials in Terra-cotta and Blue Colours.

Tools used by Slater.—The tools used by the slater are the axe (a combined tool of slate cutter or trimmer and a nail holder and used in conjunction with an iron dog, which is driven into the seat in front of the operative upon which he cuts, trims, and holes the slates according to the lap required), a hammer and a ripper (the latter is a long, flat, steel tool hooked at the end used to insert under a broken slate to cut the nails), and a gauge (a piece of flat wood with two nails driven through, one to bear against the slate edge while the other marks the line where the holes will be punched). The slater upon roof work works from a broad plank supported by tapered stools which are held in position by means of ropes tied to some roof member. Fig. B shows some typical slaters' tools.

Repairs.—Through wind pressures, and heavy snowfalls, the roof, if not designed to meet such demands made upon it, will probably sag and spread, resulting in strained ridge tiles, cracked skews, loose slates, fall of the pointing from the under side and a continuous crack across the plaster ceiling immediately under the roof truss, and probably others more or

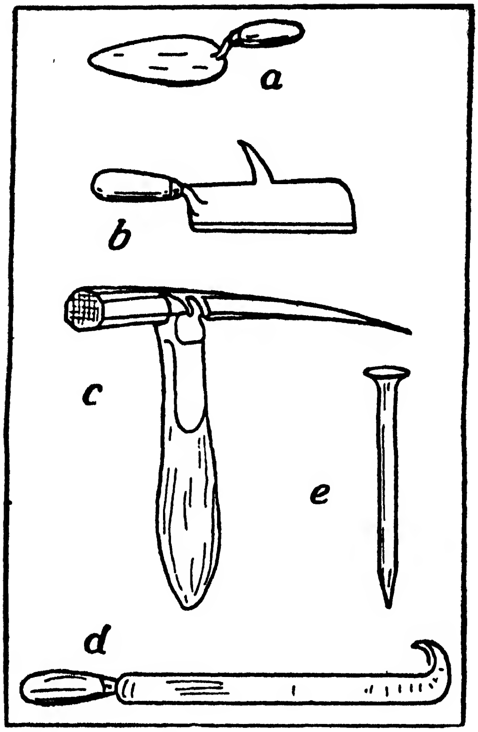


Fig. B.—Slaters' Tools: *a.*—Gauge Trowel; *b*, Axe; *c*, Hammer; *d*, Ripper; *e*, Slate Nail.

less diagonally with the angles of the room below. A very light form of ladder termed a hen run, made of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. battens with a head stock of a $4\frac{1}{2}$ in. by 2 in. to grip the ridge, is employed when repairing, because being light it is easily moved about.

Lead Flashings.—Lead flashings to roofs and chimneys sometimes work loose; small lead wedges may be cast and driven into the brick joints to secure them. Skews of mortar may be repaired with haired mortar as used for plastering, but with an addition of cement; all defective places should be well wetted before. Of patent roofing materials, *Ribo*, *Texo*, *Rufoid*, and *Slatex* are very much used. The first two are black plastic compounds containing asbestos, and are very adhesive. They are ready for use in the container, or the hand board may be used to support some according to desire. Slatex, another preparation in liquid form, is used to render porous slates waterproof; otherwise dirty and stained ceilings, apart from rotted timbers, will result from the water drips.

Cracked Slates.—Cracked slates, slates that have slipped, or even newly inserted ones, are made water- and weatherproof by these compositions used either above or below the roof. The advantages are that they are not affected by atmospheric conditions. In hot or cold weather they expand and contract to meet rapid changes. To cut out a broken slate, the ripper tool is inserted under the slate until it grips the nail, a sharp click then cuts the nail, thus freeing the slate. Slates may also be secured by means of a strip of zinc, lead, or copper, nailed to the battens, binding up the other end to grip the slate. A neater method consists of

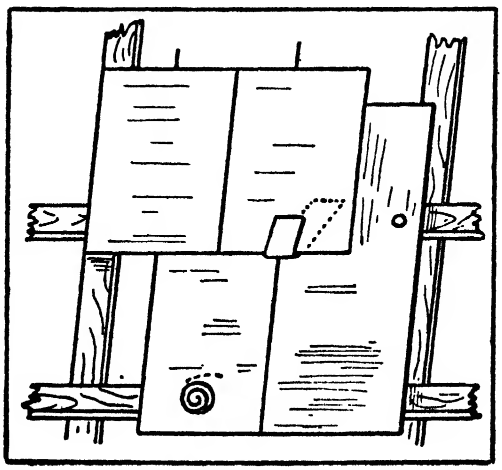
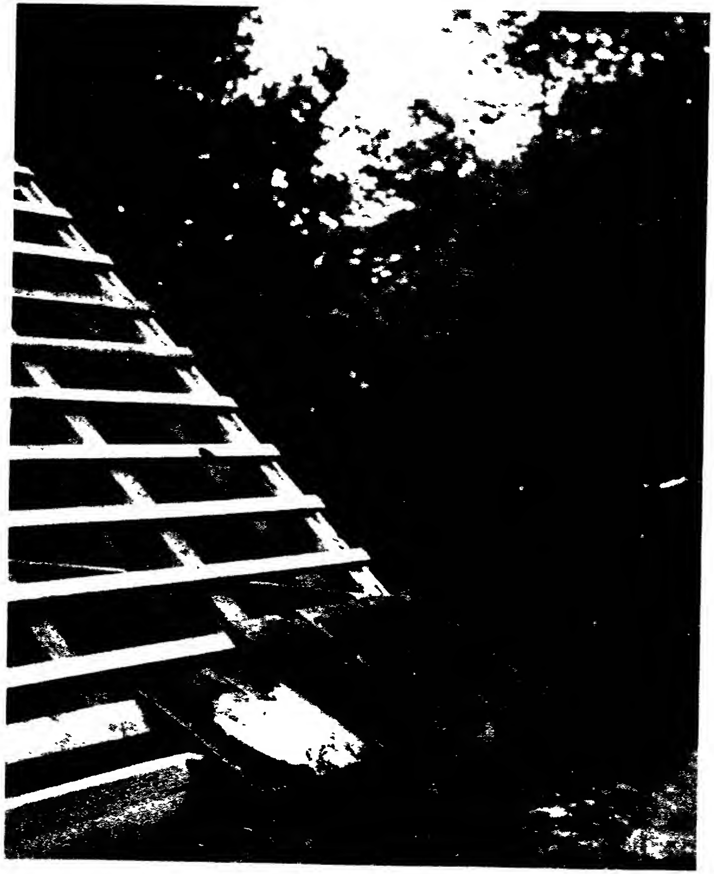


Fig. C.—Slate Roof Zinc and Wire Clips to support Slates that have slid down.



L ouble Course of Tiles is laid at the Eaves, the First or Lower Layer of the Tiles being shorter than the Second, which are Ordinary Full-length Tiles. They are embedded in the Mortar spread on the Lowest Course

12. The Course of the Tiles next above the Doubled Eaves is commenced with a Half-width Tile so that the Joints in each Course are overlapped by the Tiles in the Course above. The Tiles in every Third or Fourth Course are nailed as shown above.

HOW TO T LE A ROOF.

securing a piece of copper wire to some suitable roof member, then drawing the other end through a small hole in the slate, forming a tight spiral of about $\frac{3}{8}$ in. diameter.

Tiles.—Tiles are selected for their colour and shape and are now much used as roofing material. Their mode of fixing varies, as some, like the Marseilles tile (Fig. D), are made to interlock, some are made to be secured by wires, while others hang from the battens from ribs similar to the very old fan tile. Glass tiles to any shape for lighting purposes may be obtained. Ridge and hip tiles are usually supplied to match. The foot tile of the hip should be prevented from slipping by fixing, by means of screws to the hip, a piece of flat iron bar turned up against the end of the tile.

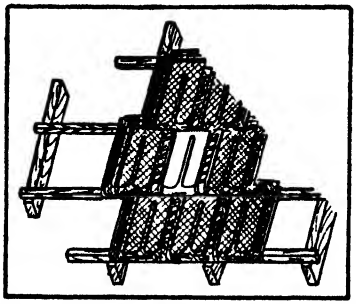


Fig. D.—Marseilles Tiled Roof showing a Glass Tile of the Same Design.

Tiles may be quite easily cut by means of the tiler's hammer by tapping along the part until it breaks off. As with slates, the under surfaces are torched with haired mortar, while damaged tiles may be successfully repaired with a red fibrous and plastic compound, specially made for such work. When it is desired to install a skylight or ventilator, the slates or tiles are removed, then the battens and rafters are cut, when trimming pieces of timber are axed, to which the frames will be screwed. Before retiling the frame should be flashed with sheet lead, for at least 4 in. under the tile, the lead along the foot being upon the top of the tile.

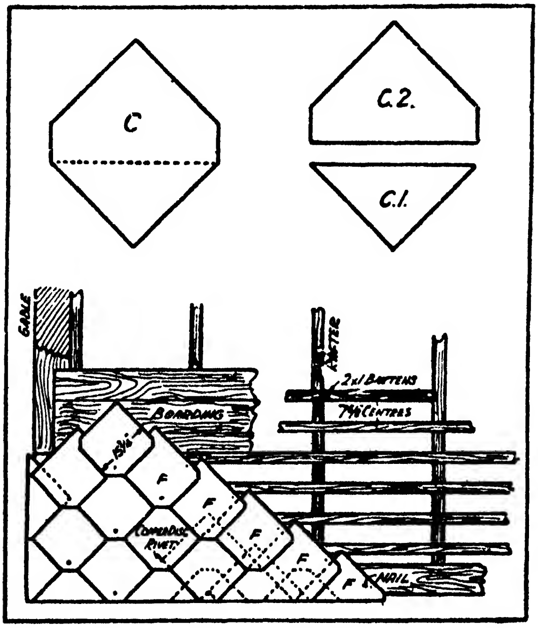


Fig. E.—Asbestos Cement Tile Roofs, showing Tiles fixed diagonally and Method of cutting Tiles to fit the Eaves.

Asbestos Cement Tiles.—Asbestos cement tiles are light in weight, therefore they require lighter roof timbers, and are red, brown, and grey in colour, and are fixed diagonally to battens with zinc or copper nails, or disk rivets. The standard tile is $15\frac{3}{4}$ in. by $15\frac{3}{4}$ in. (Fig. E), and is cut so that the smaller diagonal portion will be nailed along the line of eaves, the remaining portions then being used as starters, care being taken to break the joints. Temporary buildings may be wholly covered with asbestos

cement sheets of $\frac{1}{8}$ in. thickness, and to about 8 ft. by 4 ft. dimension. Old English half timber may be represented by sawing the sheets and fixing to such sizes that the joints may be covered with wood flats, say about 3 in. by $\frac{5}{8}$ in. thick. Corrugated asbestos cement sheets are made in lengths of about 8 ft. by 2 ft. 3 in. by $\frac{1}{4}$ in. thick; requiring less roof timbering, they reduce maintenance costs, are very durable, and are fixed with stout nails and washers.

Corrugated Iron Roofs.—Corrugated galvanised iron sheets are principally used for temporary buildings as they decay early unless painted frequently; usually cork dust is thrown upon the wet paint to arrest condensation upon the under surface, which may collect and drop. To repair decayed portions, pieces of the sheet cut to size are bedded down with Rito or a black cement. "Smooth-on," or pieces of coarse canvas saturated with the paste, may be laid over which when firm may be finished off smooth with the corrugation, using as tools a feathered-edged wood board, and a round-ended gauging trowel. The roofs of outhouses could be open lathed and covered with concrete or covered with *expanded metal* and plastered with haired cement mortar.

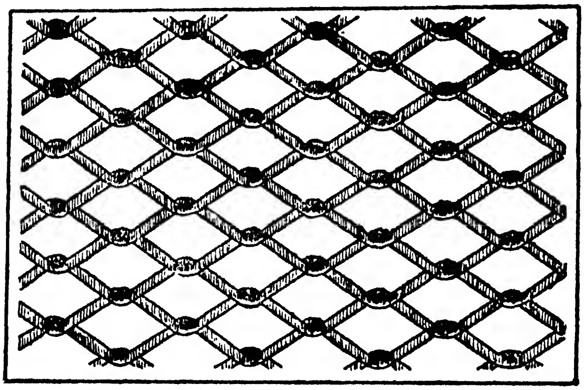


Fig. F.—Cement Roof Reinforcement, showing Type of Expanded Metal used.

Asphalt Coverings.—Asphalt, a bituminous compound, is used upon all flat or very low-pitched roofs of wood construction. The construction of the timber-work consists mainly of joists resting upon brickwork and supporting the flooring boards upon which the hot asphalt is laid, though for large spans steel girders are placed under the joists. The boards are covered with felt upon which wire netting is stretched and nailed down before the first layer of asphalt is spread, to be followed immediately with the second application. The asphalt, melted in a boiler upon the site, is supplied to position in a molten state and is spread and smoothed with wood hand floats.

Concrete Roofs.—Concrete roofs are specially designed according to requirements, and are constructed upon false timber work or forms, the proportions of the aggregate being usually four crushed whinstone, two of sand, to one part of Portland cement. The reinforcement (Fig. F), generally consisting of mild steel bars or expanded steel sheets, is placed after an inch of concrete has been placed, following up to the required thickness. The surface is usually rendered with a waterproofed thickness of $\frac{3}{4}$ in. Fig. G shows another example of expanded metal reinforcement.

Special Materials.—Pudlo is generally used with the cement mixture. Concrete roofs are mostly asphalted, though occasionally covered with Rufoid. The Rufoid is used out of iron containers and is spread to $\frac{1}{8}$ in. thickness with the trowel, and smoothed as it hardens.

Rexilite roofing felts of single and multiple ply are recommended for wood structures. Ruberoid and Pluvex are also used.

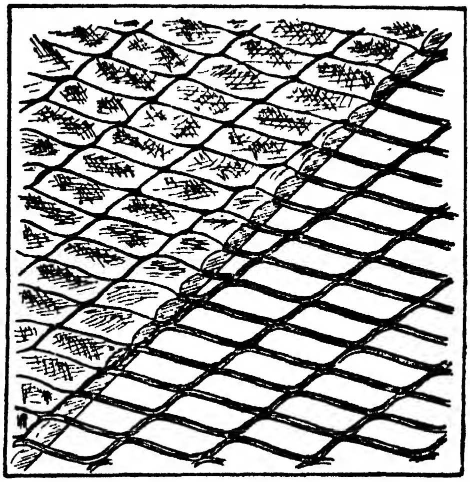


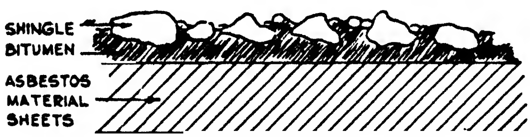
Fig. G.—Another Type of Expanded Metal, partly coated with Cement Mortar.

SLATES, REPLACING ON ROOF

To repair a slate roof by replacing with new ones, a usual method is to nail a strip of copper or stout zinc to the rafters, pushing the slate well into position and then bending over the strip on the face of the slate, thus preventing it from sliding down. A much neater job may be made by securing a piece of copper wire to a nail driven into the rafter, then bringing the end through a hole pierced in the slate about 3 in. up and central. The wire, being through the slate and the slate well into position, is turned neatly round and round into a tight spiral form of about $\frac{1}{2}$ in. diameter. If this is done neatly it will not be seen from the street.

STUCCO WORK, IMITATION

Imitation stucco work which cannot externally be distinguished from the real finish can be obtained on any of the asbestos sheet materials, such as Eternit, used for partitions and walls of buildings.



Imitation Stucco Work on Asbestos Sheet.

The method is to cover each sheet with a generous layer of hot bitumen or pitch, and whilst hot to scatter the shingle or very small pebbles over the surface. On drying, the stones are held rigidly by the medium and will stand any amount of exposure to rough weather indefinitely.

It is best to coat the finished product with a good waterproof distemper or cement wash; a spraying method is the quickest.

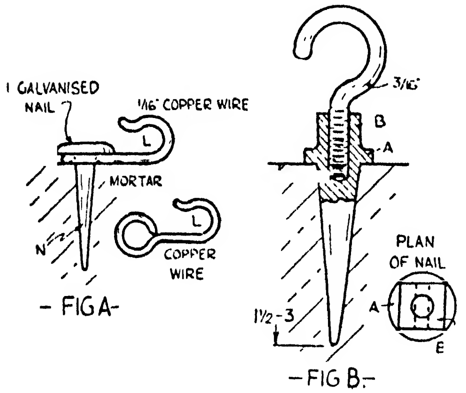
The asbestos sheets should be laid flat when coating with the bitumen.

WALL FIXTURES FOR OUTSIDE BRICKS

The two devices illustrated here will serve as useful fixtures for outside brick walls.

Fig. A shows a method employed to train the stems of wall-climbing plants such as climbing roses, wistaria, and jasmine in their proper positions. An ordinary flat-sided galvanised wall nail N (Fig. A) is used, the stem of the plant being held in the soft copper wire loop L; the latter is bent, with fingers, loosely around the stem. This is by far the neatest and quickest method of securing climbers to walls. The nail N should, of course, be driven into the mortar between the bricks.

Fig. B shows a good scheme for fixing special fittings, such as hooks, eye-screws, knobs, etc., to brick walls. A special type of nail must be made, having a tapered flat-sided driving portion, a flanged part A, and a square head B. The nail is tapped $\frac{3}{16}$ in. Whitworth for small fixtures, and with larger-size threads for heavier ones. The nail is driven into the mortar by means of a tubular punch bearing on the portion A, or with a copper drift on the square head portion. The latter is held with a spanner whilst screwing in the hook, or other fixture, to prevent any loosening of the mortar about the nail; an exceedingly strong fixture can be made in this manner.



Two Handy Wall-fixing Devices.

Instead of driving cut nails and other wall-fixing devices into brick walls a better plan is to use Rawlplugs for the lighter fittings, such as screw-hooks and screw-eyes. A full account of Rawlplugs and the method of using them is given under "Wall Plugs and Wall Fixtures."

For heavier fixtures to outside walls, Screw-anchors or Rawlbolts should, preferably, be used. These, also, are described in the section previously mentioned.

WALL NAILS

Frequently on putting in a nail or screw the plaster gives way, and the hole becomes large and ugly. This difficulty has been successfully avoided by boring a hole with a bradawl and pressing into it a little Seccotine. Then drive in the nail or screw, and leave to dry. The next day the nail will be quite firm, and will last so for years. If the hole is accidentally enlarged, soak some cotton wool in liquid glue and plug the hole. Then insert the screw and leave to dry hard.

WALL PLUGS, WOODEN TYPE

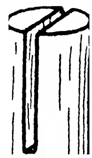
Fresh holes very often have to be made in the walls for fixing the furniture. These holes are, if badly done, very unsightly and none too good a fixture obtained.

The following method is a way of ensuring neatness and strength with the minimum amount of labour and expenditure.

First of all procure a length of suitable wood rod, about $\frac{1}{2}$ in. diameter (the broken handle of a mop was used in the writer's case) with the grain running lengthwise. Cut off lengths of $1\frac{1}{4}$ in., or more if firmer plugs are desired, and slot down centre to a depth of $\frac{5}{8}$ in. The thickness of the saw-cut is all the magnitude required. Proceed with another piece of wood (preferably deal) $\frac{1}{8}$ in. thick, $\frac{1}{2}$ in. wide (width same diameter as plug) and length according to number of plugs to be made and cut off pieces of $\frac{5}{8}$ in.

Taper one end to the shape of a wedge and insert in the slot in the plug. Drill a hole in the wall at the required position with brace and bit, using a drill the same diameter as the plug, for a depth equivalent to the length of the plug, plus $\frac{1}{4}$ in.

Place the plug and wedge in the hole, the wedge going in first, and gently tap home with hammer. The blows of the hammer drive the plug on to the wedge, and as the wedge is stationary up against the wall at the end of hole, it automatically opens the slot and thus causes a tight jamming effect against sides of hole. A piece of furniture can now be screwed on the plug, with no fear of "give." The dimensions of the plug, wedge, and hole may be varied according to size of job in hand. Old exposed plugs can be conveniently painted over the same colour as the wall-paper or distemper, thereby concealing them. This, the writer feels sure, is a neat and inexpensive method of plugging holes for fixtures.



A Useful Wood-type Wall Plug.

[See also "Wall Plugs and Fixtures."]

WALL PLUGS AND WALL FIXTURES

A very frequent home requirement is that of fixing objects to the interior and exterior walls of the house; it is an operation which few persons can undertake efficiently without a knowledge of the proper methods.

Ordinary Nails Unsatisfactory.—The method of using ordinary French or cut nails is by no means satisfactory, for unless one happens to select just the right kind of nail, and is lucky enough to drive it into the mortar layer between the bricks, it will not hold; moreover, a long cut nail is required, and wood screws cannot be employed. Very often one finds that a big piece of plaster is broken away where the nail enters, thus disfiguring the wall.

Again, in driving the nail into the wall a series of heavy blows must be given, and unless the nail is hit squarely every time it either bends or works loose in the hole.

Wood Screws.—An alternative method that has been employed in many cases, where wood screws were required to fix objects to walls, was to cut with a cold chisel a square-section hole in the wall, and then drive in a tapered piece of wood. The wood screws were then screwed into this plug.

This method if properly carried out gives satisfactory results in many cases, but in some instances the plug has been found to work loose. either through shrinkage or breaking away of the plaster around it.

A good method of ensuring a firm plug of this type is actually to cement it into place, making the plug taper towards the front of the hole so as to obtain a kind of dovetail effect.

Rawlplugs.—By far the best method of fastening objects of all kinds to the walls of buildings is that of using Rawlplugs or Metlex wall plugs. The operation of making the hole, inserting the plug, and driving in the screw has been so simplified by the use of proper tools and materials that any amateur can readily master it.

In both types of wall plug the plug is pushed into a hole, of slightly larger diameter, made in the wall, and the screw inserted in the same manner as when screwing into wood. The action of the screw is to expand the plug all along so as to obtain a firm grip on the sides of the hole.

When used in hard materials such as stone, concrete, or brick, a very strong hold is thus obtained; so that objects—whether light or heavy—can be attached to the wall with absolute security. It is of course, necessary to use the correct size of plug and screw.

How to make the Holes.—In the case of both types of special plug mentioned, a comparatively small hole is made in the wall—usually about twice the diameter of the wood screw to be used; there is thus a good support given by the wall close to the screw.

Referring to the Rawlplug method first, the hole is made in the wall with a special fluted punch, with a conical point (Fig. A, 1). This is a hardened steel tool that is held as shown and given a fairly quick series of sharp taps with the hammer, at the same time rotating it so as to prevent jamming. The particles of the wall material loosened by the point work out along the flutes, so that it is unnecessary to remove the tool for cleaning these particles away.

This tool will make a circular hole in any kind of wall—for example concrete, breeze, brick, or plaster; it can also be used in marble, slate, stone, asbestos compounds, tiles, and glazed bricks. Having made the hole, the plug is inserted as shown in Fig. A, 2, and finally the wood screw driven in as shown in Fig. A, 3.

Using Twist Drills.—For softer kinds of material such as the softer kinds of marble, slate, and stone it is sometimes preferable to use an ordinary metal-type twist drill.

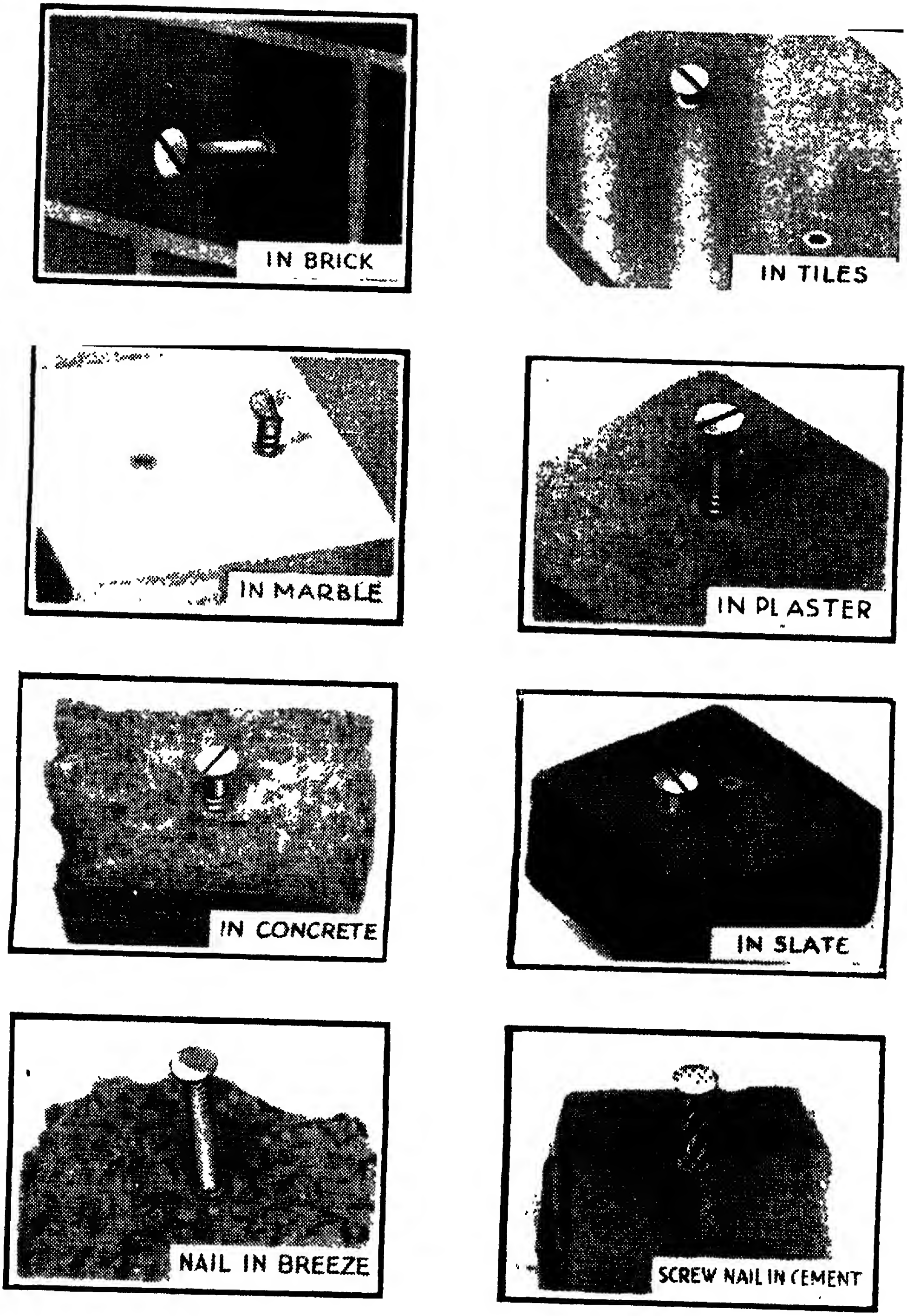
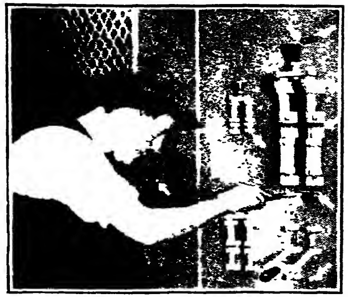


Fig. B. - SHOWING THE VARIOUS KINDS OF MATERIALS IN WHICH RAWLPLUGS CAN BE EMPLOYED.

(1)

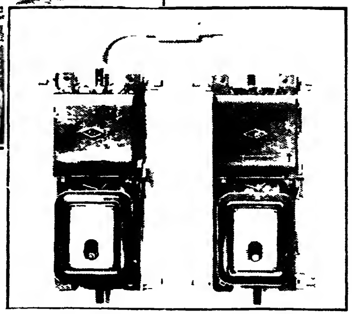


(2)

Fig. C. Rawlplugs used for (1) fixing Capping and Casing to Plaster (2) Fixing Electrical Fittings (e.g. Switches) to Slate Switchboards.

Note: The White Arrows indicate where Rawlplugs are used.

(1)



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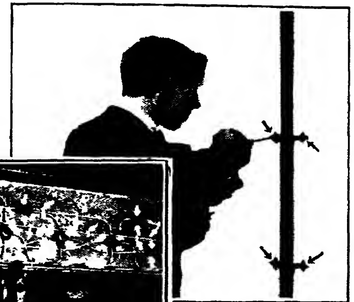
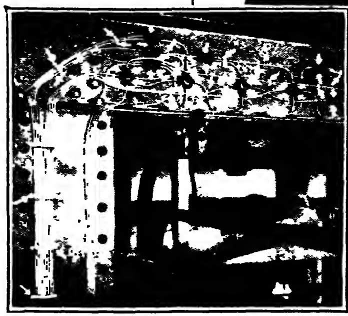


(3)



(4)

Fig. D.—SOME FURTHER EXAMPLES OF RAWLPLUG APPLICATIONS.

(1) Fixing Electric Light Bracket to Wall (2) Electricity Meters to Wall (3) For Water and Conduit Pipe Clips to Wall (4) Electric Wiring to Steel Girders.

Note. The White and Black Arrows indicate where Rawlplugs are used.

Plaster walls, which are liable to break away when using percussion tools, can more satisfactorily be drilled with twist drills.

Lath and Plaster Walls.—When fixing to soft plaster a special bullet bit made by Messrs. Rawlplug should be used. When using the bullet bit pierce by giving the toolholder firm blows with a hammer of medium weight. Then remove the tool by rotating it. For hard plasters the jumping type of tool previously mentioned should be used. If the articles to be fixed are heavy, do not rely upon the soft plaster, but drive the hole for the plug right through into the brick.

Plaster and lath walls are perhaps the most difficult to fix to, as usually the plaster is very soft and friable. The best possible fixing to be obtained can be made by means of a Rawlplug inserted to its full length, and when the hole made in plaster happens to come between the laths the plug can be prevented from slipping through and being lost by opening out the end.

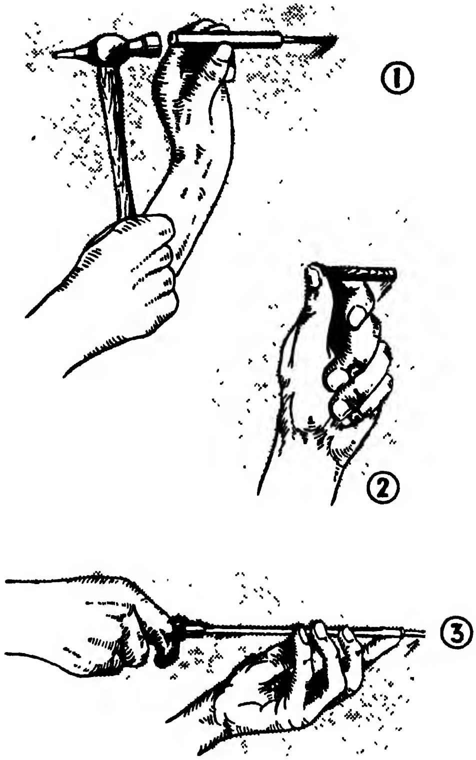


Fig. A.—Illustrating use of Rawlplugs. (1) Making the Hole. (2) Inserting the Rawlplug. (3) Inserting the Wood Screw.

Correct Size of Tool and Screw.—It is important to employ the correct size of drill or tool to suit the Rawlplug and wood screw used. The plugs in question are made of a specially treated fibrous material of a hard nature. The tools are applied in a number of standard sizes, as follows:

Size of Rawlplug	3	6	8	10	12	14	16	18	20
Sizes of wood screws for which suitable	1, 2, and 3	4, 5, and 6	7 and 8	9 and 10	11 and 12	13 and 14	15 and 16	17 and 18	19 and 20
Size of French wire nails	14 and 15	12 and 13	10 and 11	9	8	6	—	—	—

For larger holes and heavier jobs a special series of Rawlplugs is available. These are as follows:

Size of Rawlplug	22	24	26	28	30
Will take the following sizes of gimlet-pointed coach screws	$\frac{3}{8}$ in.	$\frac{7}{16}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.

Rawlplugs are also supplied in various lengths for each size of plug. The wall boring tools are supplied in a series of sizes designated with and corresponding to the same numbers as those of the plugs themselves, as given in the above tables.

WALL POINTING

When the pointing of a house has deteriorated badly, the building not only has a very dilapidated appearance, but it is likely to become damp, as the open joints allow rain to obtain access to the interior of the walls and to soak through the mortar. A house that has been neglected is bound to suffer in this respect in time, and may cause a good deal of expense if it is not attended to. It is not a very difficult matter to remedy the trouble, and as very few tools or materials are required, it is well within the power of the average house-owner to carry out the operation if he desires.

Tools.—The necessary tools will be a pointing trowel and a raker, and some means of access to the higher portions of the wall will have to be provided. The work can generally be carried out with a ladder if there is not a great deal of pointing to be done, but it will not be very convenient where there is a large area of brickwork, and it will be better to erect a scaffold.

Materials.—A bushel of washed sand and a peck of lime will be all the materials that are needed. The lime should be wetted and left over-night to slack, after which it can be mixed with the sand into mortar ready for use. As a general rule it will be an advantage if a little Portland cement is added to the mortar, or, better still, if cement is substituted for the lime altogether, the work will last much longer and will not cost very much more. The mortar should be well worked up with a shovel to make it " fat," as it is then more easily manipulated.

Preparing for Pointing.—Before the pointing is commenced the old mortar must be raked out of the joints to a depth of ½ in. to provide a key for the new material. The raker can be made by flattening the end of a piece of iron and turning it at right angles, as in Fig. A. Alternatively a steel chisel can be used, or anything that will scrape the old mortar away. The raking can be carried out in sections of about 1 yard square or as far as can conveniently be reached. Afterwards the brickwork should be swept down with a stiff, scrubby brush, to remove dust and loose particles.

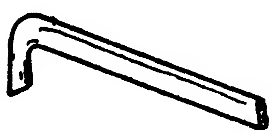


Fig. A.—The Raking Tool used before Pointing.

One of the most important things is for the whole of the brickwork to be well wetted before the pointing is applied. This can be done by pouring water over the wall with a can, but it is essential that the bricks are well saturated, or the mortar will not adhere and will in time fall out.

... shown and then render the Surface with a mixture of Mortar and Hair.

(2) Apply the Mortar to the Studding as indicated, going over the Surface with the Float shown. The Rough Finish left forms a Key for the Fine Plaster Coat used for Smooth Finishing.

MAKING A PARTITION FOR A ROOM

Pointing.—The pointing is applied by taking a small portion of the mortar on the end of the trowel and pressing it firmly into the joint, forcing it well back into the opening so that it can obtain a good mechanical bond. The mortar is then smoothed off to a straight, unbroken surface, by drawing the edge of the trowel along to joint with a long, sweeping stroke, the edge of the trowel being pressed inwards a little at the top, so that the mortar is sloped outwards at the bottom of the joint to shed the rain. Some bricklayers press the *bottom* of the joint inwards, as this is rather less trouble, but it provides an opportunity for water to settle on the projecting edge of the brick below and thus to soak into the wall. This is a mistake, and should be avoided. The correct method is shown at A in Fig. B, the wrong method being shown at B. All vertical joints as well as the horizontal or bed joints should be done, so that rain cannot penetrate to the interior of the wall.

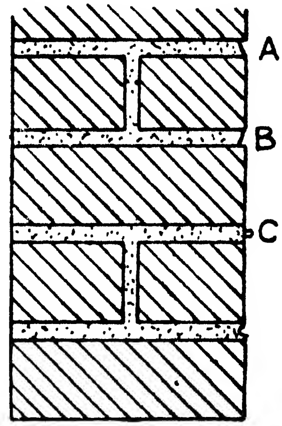


Fig. B.—A, Correct Method. B, Incorrect. C, Tuck Pointing.

Fancy Pointing.—There are other styles of fancy pointing, some of which are shown in Fig. C. Tuck pointing will be seen at C, in which the joint is first filled up flush with mortar coloured to match the brickwork, a narrow line of white or black mortar being afterwards run along on the surface with a special tool called a "jointer." Neither of these methods is very frequently used in ordinary house building, and they will not appeal to the amateur mechanic as a rule.

WATERPROOFING WALLS

Interior walls may be rendered waterproof by painting with a special paint made up as follows :

Dissolve ¾ lb. of Castile soap in 1 gal. of water. In another vessel dissolve ½ lb. of pulverised alum in 4 gal. of water. The walls must be clean and dry, with the temperature of the air preferably not above 50°—preferably, because it is not always possible to get conditions just as one would have them. The first coating is that of the soap solution, which must be laid on hot, using a flat and wide wall brush. Be careful not to cause a froth to form. Allow this coat to dry twenty-four hours, then apply the alum water at a temperature of 60° to 70°. Let it remain twenty-four hours. It will be found rather difficult to apply this alum solution, for the soap wash forms a very hard surface that the alum water runs from, as the water runs from a duck's back. Therefore it is necessary to rub it on well and hard. Now apply a coating of soap solution again, after the surface has stood twenty-four hours to dry, then after another twenty-four hours the alum size again. This completes the process. The insoluble alum filling the plaster forms a waterproof coating. Water cannot pene-

trate it, neither from front or back, so that it makes a safe foundation for paint or paper. The four coats have been applied all in one day, and with satisfactory results, but each coat must be perfectly dry, otherwise there would be failure. Considering what is accomplished when it is well done, it will pay to give the four days to it.

SECTION 2

CARPENTRY AND WOODWORK

The woodworker at home need not start by buying a large number of tools, but should preferably get a few at a time as he wants

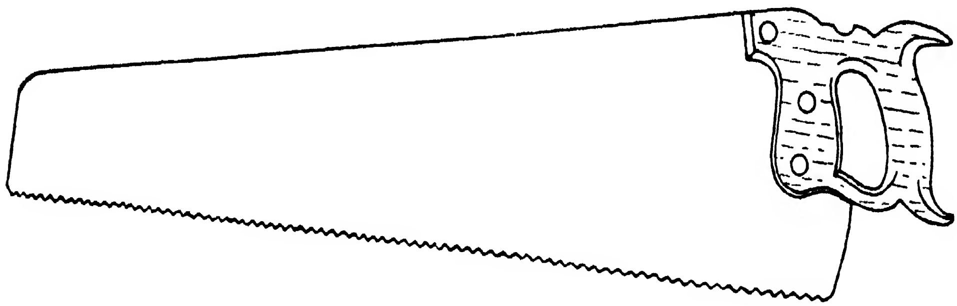


Fig. 1.—Handsaw.

them and choose those which are likely to be frequently needed. It is nearly always possible to make shift without tools which are rarely wanted, and if they are bought and lie idle they may spoil with rust unless time is spent cleaning and keeping them in condition.

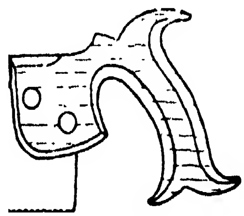


Fig. 2.—Tenon Saw.

Saws.—Some types of saws often wanted for home work are shown in Figs. 1, 2, 3, and 4. The first is the ordinary handsaw. For rough outdoor work no other saw may ever be necessary. It is made in a variety of sizes and number of teeth to the inch. For ordinary work a length of 24 in. or 26 in. is convenient.

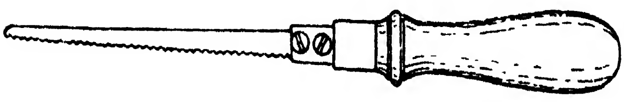


Fig. 3.—Keyhole Saw

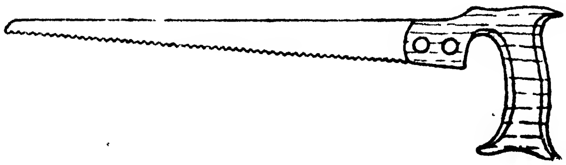


Fig. 4.—Compass Saw.

For finer work done at a bench the tenon saw may be wanted more than a handsaw. The keyhole and compass saws are narrow, which allows them to follow curves. But the chief use of the keyhole saw is for entering and starting a cut from a bored hole when interior parts have to be cut out. Neither a hand nor a tenon saw can do this, though in the case of a long cut the handsaw may be used for speed after the keyhole saw has proceeded far enough to allow the larger saw to be inserted. The compass saw has a larger blade, but it is made also with a set of three interchangeable blades, the smallest being the same as the keyhole saw.

Boring Tools.—The boring of holes in wood may be done with a brace and bit, Fig. 5, or with a gimlet, Fig. 6, or bradawl, Fig. 7. Bits in common use with the brace are shown in Fig. 8, A, B, C, D, E. The gimlet and bits A and B are used for boring holes for screws. The gimlet is slow, but is sometimes more convenient than the brace and bit. The bradawl does not screw into the wood by continual turning in one direction, but is pressed in with a turning movement in alternate directions. It is sometimes used for fine screws, but more frequently for nails which might split the wood if driven in without boring a hole. The bits are turned by the brace.

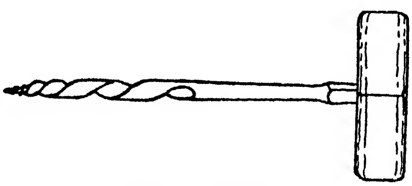


Fig. 6.—Gimlet.

Fig. 7.—Bradawl.

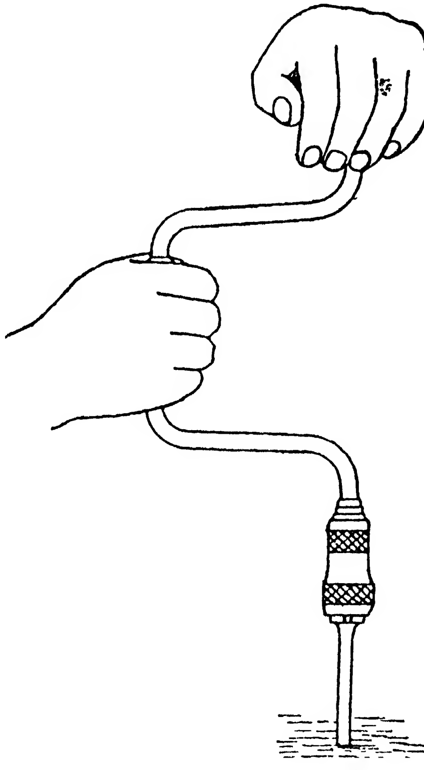


Fig. 5.—Brace and Bit, for boring Holes.

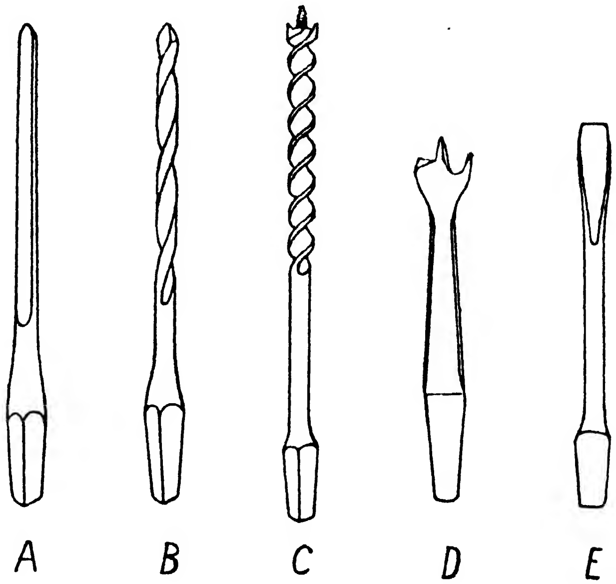


Fig. 8.—Typical Bits.

A.—Shell Bit. B.—Twist Bit. C.—Auger Bit. D.—Old-pattern Centre Bit. E.—Screwdriver Bit.

Diameters of bits A and B range from $\frac{1}{8}$ in. to $\frac{3}{4}$ in., the most useful sizes not exceeding $\frac{1}{4}$ in. Bits C and D are used for holes which need accurate boring on a given centre, and are generally of larger diameter than screw holes. They range from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. Screwdriver bits, countersink bits, and reamers are also used.

The brace may be plain or with a ratchet movement, the latter allowing short turns to be taken with a kind of freewheel action back during which the bit is stationary. It is useful when there is not room for complete revolutions of the brace, and also it gives more power when the brace is being used for tightening screws. The ratchet can be easily thrown in or out of action.

Chisels and Gouges.—Chisels, Figs. 9 and 10, are ground on one face only, and can be used in either of the positions in Figs. 11 and 12. In the Fig. 11 position the chisels bear on the surface for some distance behind the cutting edge, and this makes for uniformity in depth and straightness of cut.

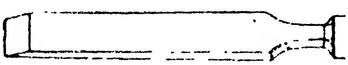


Fig. 9.—Ordinary Wood Chisel.

Gouges, Figs. 13, 14, and 15, are curved in the direction of their width.

Fig. 10.—Socket Chisel; generally driven with a Mallet.

Some are ground on the outer or convex face, others on the inside. A gouge ground on the inside can only be used lying flat on its outer face,

like the chisel in Fig. 11. A gouge ground on the outside can only be used in the tilted position. For ordinary work the latter class of gouges are the most useful, and the straight ones are preferable to those which are curved lengthwise. Gouges vary in width and in curve. Chisels and gouges may be pushed by hand or driven by mallet blows.

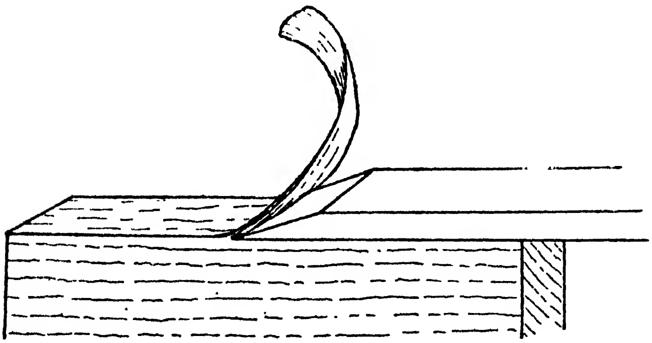


Fig. 11.—Ordinary Cutting with Wood Chisel.

Planes.—Sawn wood has a rough surface which can be made smooth by planing, and at the same time corrected when untrue and reduced to an exact thickness if necessary. The wood is laid on a bench or held in a vice and the plane is pushed over its surface in strokes of convenient length. Three varieties of plane are shown in Figs. 16, 17, and 18, but there are many others.

The jack plane is used for roughing down. Its cutter is not ground absolutely straight across like a chisel, but is curved so that it will cut a shaving thicker in the middle than at the edges. This is the only way to plane thick shavings, for if the corners of the cutter project enough to dig in they make ridges on the surface and the shavings choke the plane. The jack plane therefore produces a series of shallow waves on the surface of the wood, which are afterwards reduced by planes with straighter edges cutting thinner shavings. The smoothing plane is one of these, but on large surfaces which have to be made perfectly true a larger plane than the jack is used. These planes may be of wood, as illustrated, but iron ones are sold also, at a higher cost than wood.

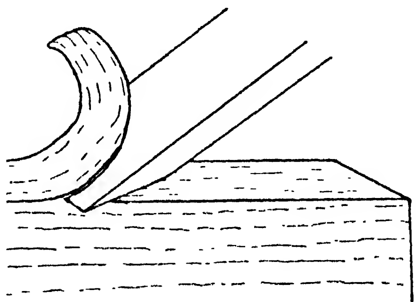


Fig. 12.—Chisel used with Flat Face upwards.

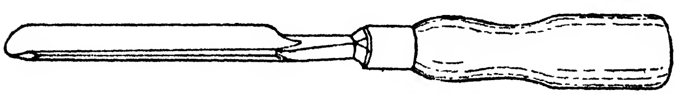


Fig. 13.—Firmer Gouge ; ground on the Outside.

Small metal planes of various types are common, and for home use

Fig. 14.—Paring Gouge; ground on the Inside.

Fig. 15.—Bent Gouge; used by Wood Carvers.

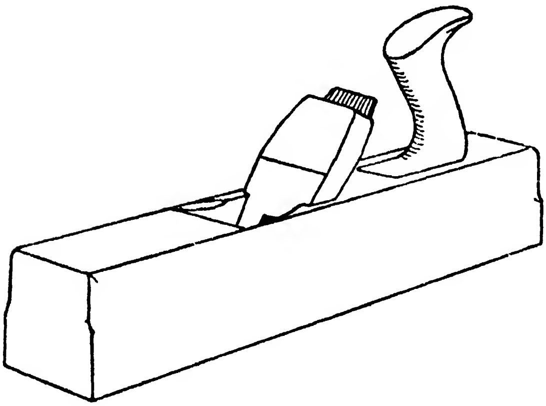


Fig. 16.—Jack Plane

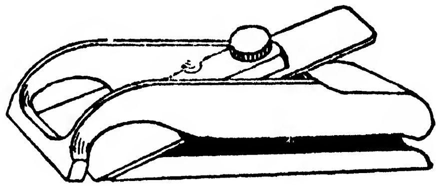


Fig. 18.—Small Metal Plane.

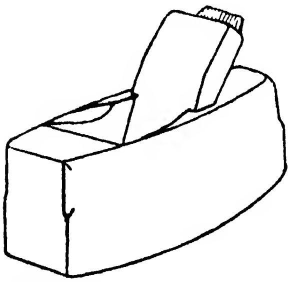


Fig. 17.—Smoothing Plane.

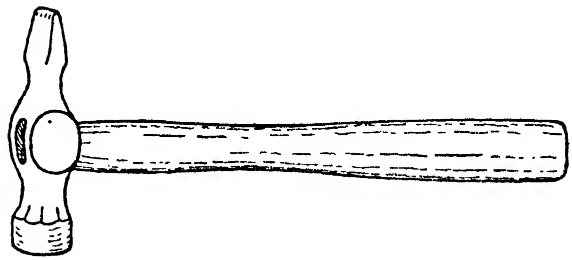


Fig. 19.—Ordinary Hammer.

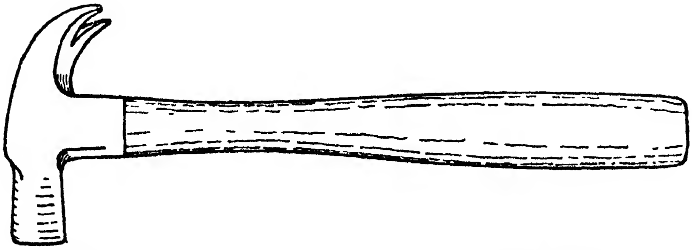


Fig. 20.—Claw Hammer; Claw used for drawing Nails.

it is advisable to have one. The one illustrated, Fig. 18, has open sides, and the cutting edge near the front. This allows it to cut close to a shoulder, as in planing a groove or tenon or rebate, and also it will cut nearly to a stopped end owing to the shortness of front beyond the cutting edge.

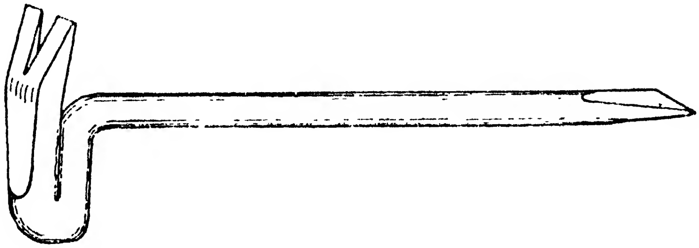


Fig. 21.—Case Opener; useful for prising Nailed Woodwork apart.

Other Tools.—A number of tools of various kinds which are frequently wanted for woodwork are shown in Figs. 19 to 30. Space is not available for

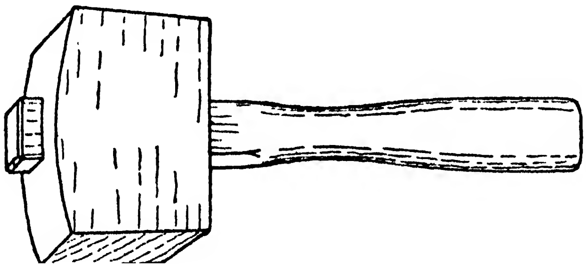


Fig. 22.—Mallet.

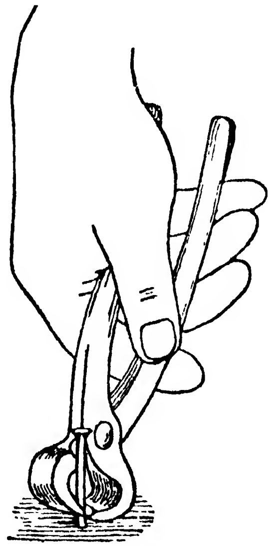


Fig. 23.—Pincers.

saying much about them, and the uses of most are well known.

The mallet, Fig. 22, is used for driving chisels and gouges. It does this more effectively than a hammer, and is less injurious to the tool handles. The pincers, Fig. 23, grip a nail below the head and draw it by leverage, the grip being shifted down a bit at a time as the nail rises.

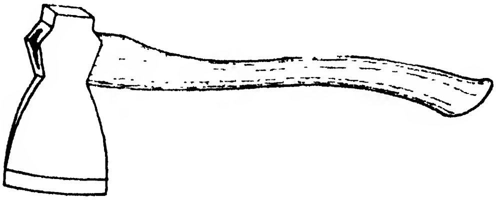


Fig. 24.—Hatchet.

The spokeshave, Fig. 25, cuts shavings on curved surfaces and is often used for trimming hatchet and hammer handles. The gauge, Fig. 27, has an adjustable block sliding on a rod which has a small projecting cutter or marker near the end. It is set to the required distance on a rule, and, with the block sliding against an edge of the wood, it cuts a line parallel with the edge. Compasses, Fig. 28, are used for marking curves and for dividing. Spring dividers are used for fine work, and trammels

for sweeps of large radius. These instruments scratch or cut lines, which for most purposes is better than pencil.

Bench.—A bench with a vice is desirable. Rough outdoor work,

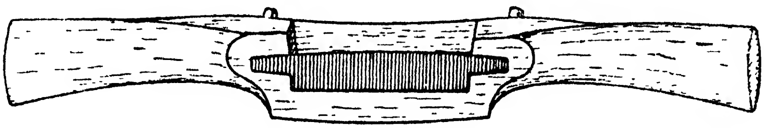


Fig. 25.—Spokeshave.

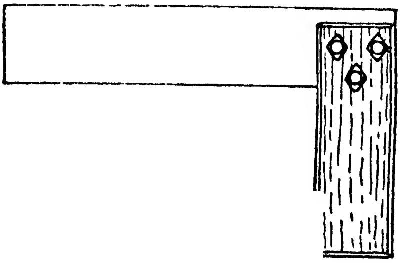


Fig. 26.—Try Square.

which consists chiefly of sawing and nailing, can be done without much need for a bench, and some indoor work can be done on a table.

An ordinary type of woodworker's vice is shown in Fig. 31. Much improved forms are made entirely of metal. The screw and nut for the kind illustrated can be bought relatively cheaply or a vice complete for about three times the price. An all-metal vice averages about five times the price. Benches complete cost from about £3 10*s*. to £10 10*s*. Cabinet benches with drawers and cupboards for tools range as high as £30.

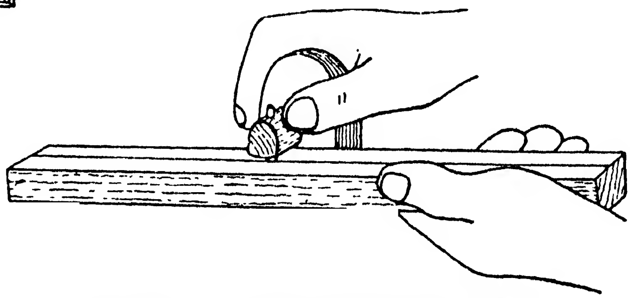


Fig. 27.—A Line being marked with a Gauge.

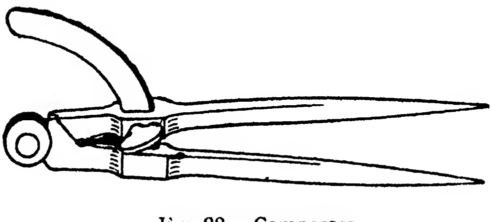


Fig. 28.—Compasses.

When planing has to be done it is necessary to have a stop to take the thrust at the front end of the wood. If a table is used the simplest way is to insert an ordinary screw with its head standing ¼ in. or more above the surface. With a bench an adjustable metal stop is best.

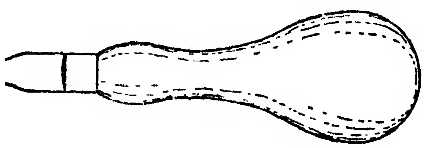


Fig. 29.—Screwdriver.

A shooting board, Fig. 32, is an appliance for use on the bench. A piece of wood can be held against its stop to take the thrust of the saw,

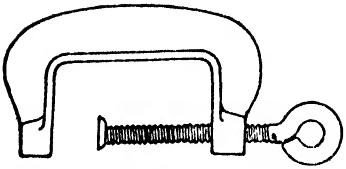


Fig. 30.—Small Cramp, for holding parts in position, thus leaving hands free.

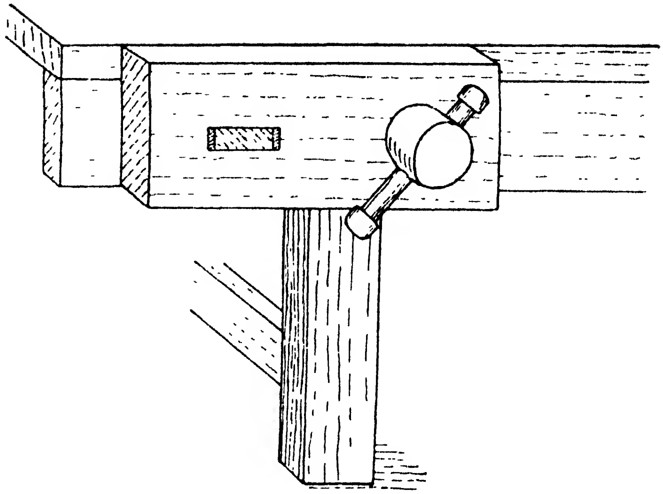


Fig. 31.—Ordinary Wood Bench Vice.

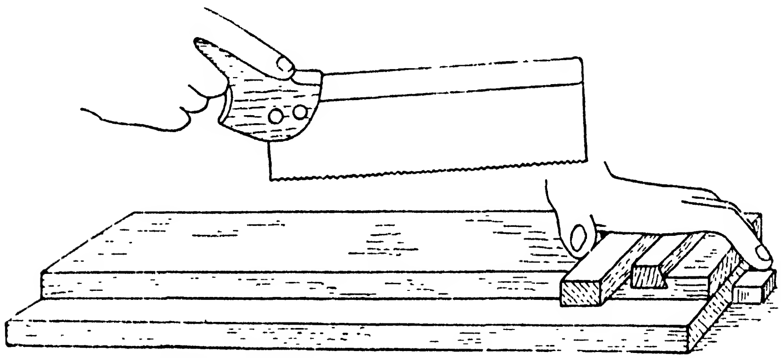


Fig. 32.—Showing One Use for the Shooting Board.

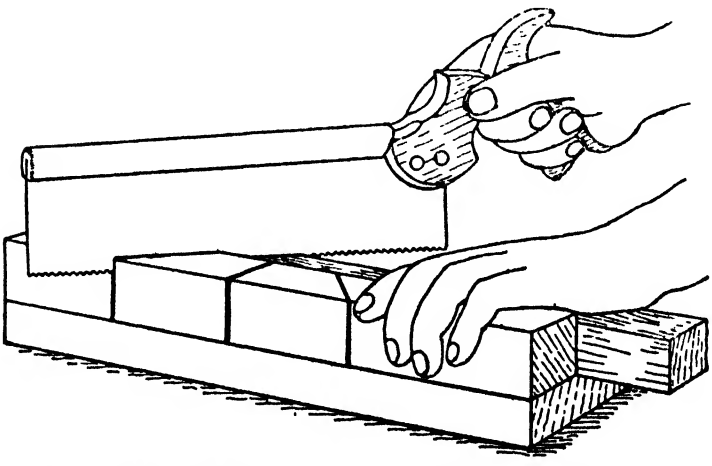


Fig. 33.—Mitre Block, used as a Guide for the Tenon Saw.

as shown, or edges can be planed by laying the wood on the upper surface, bearing against the stop, while a plane lying on its side on the step of the shooting board is slid backwards and forwards with its cutter operating on the edge of the wood, which must project slightly so that the plane will cut it. The shooting board also can be used for doing a great variety of small work on instead of working direct on the bench top.

A mitre block, Fig. 33, is useful for some classes of cabinet work and for making picture frames. It guides the saw in cutting an exact angle without having to mark lines on the work and follow them with the saw.

Wood.—Wood is roughly divided into two classes—hard and soft—the latter being the cheapest and most commonly used. There are a great many varieties of hard wood, some of them expensive and scarce, others fairly common. Such woods as oak, mahogany, walnut, belong to the hard variety and are used for good-class furniture and interior fittings of buildings. Among soft woods we have yellow pine and white-wood as the straightest grained, easiest to work, and least liable to warp, and we have the cheaper spruce and deal for common work, such as rafters, joists, and floorboards in house-building. It varies somewhat in quality.

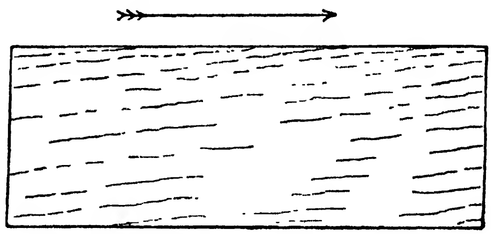


Fig. 34.—Sloping Grain which is planed in direction of the Arrow.

Besides ordinary wood there are the artificial products which are excellent where large widths of material are necessary. Plywood and wallboard do not warp or shrink or split.

A person who has had any experience in woodworking knows that wood has grain, the peculiarity of which is that a piece of wood can be split with a hatchet in one direction, but cannot be split at all at right angles to that direction. The only way to sever it across the grain is to saw it, or, if it is slender enough, it may be snapped, leaving splintered ends at the breakage. In paring with a chisel or in planing there is a difference between cutting with the fibres and cutting across them. In using a plane or chisel nominally parallel with the fibres it also makes a difference if the fibres slope out of parallel with the surface which is being operated on. Fig. 34 illustrates this. With the grain as shown the cutting tool would have to travel in the direction of the arrow. A plane used the opposite way would tear it up and leave a rough surface, and a chisel would split a tapering piece away instead of cutting a parallel chip. Sometimes grain is curly and a clean cut in one direction is impossible. This is often the case with hard wood, and cabinet-makers use planes set very finely and finish the surface by scraping.

Wood shrinks slightly in dry weather and swells with damp. New wood, which has not been thoroughly seasoned, contains sap, the gradual loss of which results in permanent shrinkage. Curvature is common unless precautions are taken to prevent it. If a piece of board lies on the ground for a few days, its upper surface becomes concave through being exposed to the air and consequently becoming drier than the under surface. A large piece of wood may warp as the result of strain. If a long board, a shelf for instance, is supported at its ends only, it will gradually sag in the middle and become permanently curved lengthwise, especially if anything heavy is kept on it. This bending will be less in a thick board than in a thin one, because the latter is more flexible.

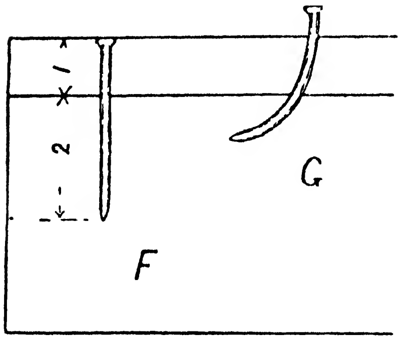


Fig. 35.—F. Nail holding Two Pieces of Wood together should have not less than two-thirds of its Length in the Lower Piece. A Bent Nail driven into Wood follows the Direction of its Point.

Nailing.—Nails are generally used in rough work or in work where their appearance is not objectionable. When there is no risk of splitting the wood, nails are driven without boring holes for them. Hard wood often needs boring where soft wood does not. For nails to hold well there must be a considerable thickness of wood for receiving their points, though the piece where their heads are may be thin. It is the custom, therefore, in nailing two pieces of unequal thickness together, to drive through the thin piece into the thick, and the latter should have not less than two-thirds of the nail length see (Fig. 35). Where both pieces are alike and comparatively thin, nails long enough to go through both are used, and their projecting points afterwards bent over and hammered down level or "clinched" (Fig. 36). This is suitable only for rough work. Where it is objectionable screws are used in preference to nails. Unless a nail is started correctly its direction cannot be changed after a good proportion of its length has entered the wood. Nailing is best done with the work on a solid base. If on a table it should be done over the leg of the table. When nails have to be driven in the horizontal direction a block of metal, such as a flat-iron, should be held against the farther side (see Fig. 37).

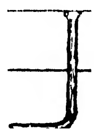


Fig. 36.—A Clinched Nail, where the Wood is not thick enough for secure Nailing in the ordinary way.

The Use of Screws.—Screws are used where great holding power is desired or where it may be necessary to remove them without injury to the work. Screws also are essential for attaching metal fittings,

such as hinges, to wood. Holes nearly always have to be bored for screws. The smooth portion of the screw between the head and the thread does not need to be a tight fit in the wood, as the thread at one end and the head at the other hold the two pieces of wood together. Therefore a hole is bored through the first piece large enough for the screw to slip in easily. In the second the hole is generally continued to receive the threaded portion (Fig. 38). If the wood is hard and the screw large, a hole nearly the full depth and only slightly less in diameter than the thread must be bored. In other cases the hole for the thread may be much smaller and sometimes no boring for it is done. It is usual to bore the second portion of the screw hole with a bradawl or gimlet after the first piece of wood is adjusted in position for inserting the screw. The upper hole may or may not be countersunk for the head of the screw. In soft wood it is easy to tighten a screw until its head is flush with the surface.

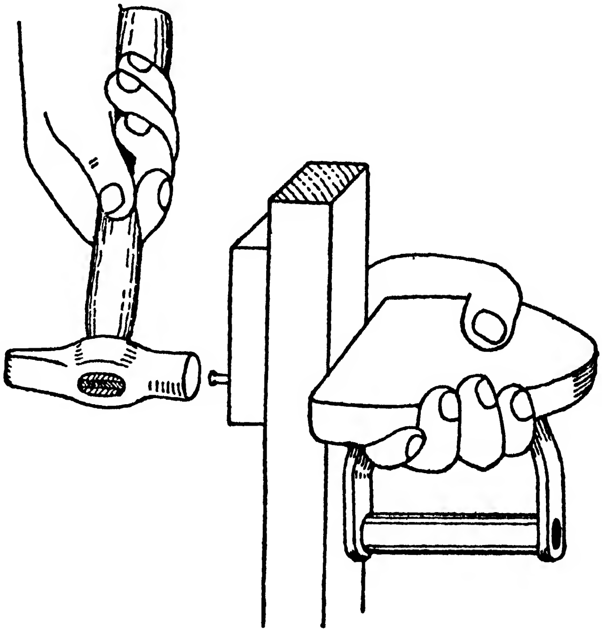


Fig. 37.—A Block of Metal, held as shown, enables a Nail to penetrate with less Vibration and fewer Hammer Blows.

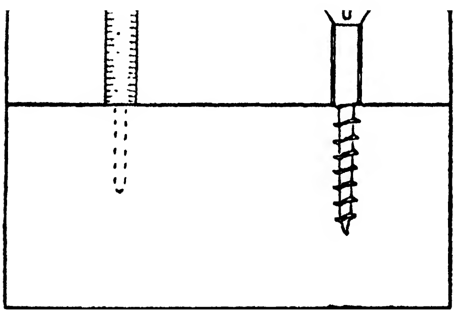


Fig. 38.—(Left) Hole prepared for Screw. (Right) Screw inserted.

In most woodwork nails or screws are the chief means of holding the parts together, and they should be put where they will be most effective without using more than necessary. Some examples of screws in corner joints are shown in Fig. 39, H, I, J, K, and in Fig. 40 their arrangement in another common type of joint, that of a cleat or batten attached to a wide board. Generally two lines of screws are used in these latter, but a very narrow batten would have only a single line.

Glue.—Glue is used considerably for indoor articles, such as furniture

and for joining pieces of wood to make a greater width or thickness. It does not hold well on end grain or on crossed grain. In many cases screws or nails are used in addition to glue. Glue is not reliable unless the parts joined fit perfectly and are kept tightly squeezed together for

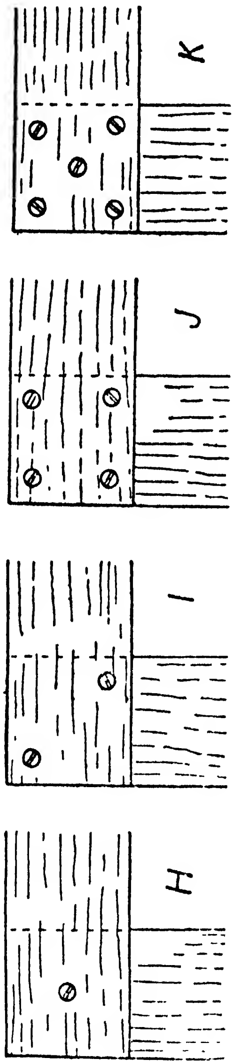


Fig. 39.—H.—Central Screw. I.—Two Screws at Opposite Corners in different Lines of Grain. J.—Four Screws. K.—Central Screw in addition to One at each Corner.

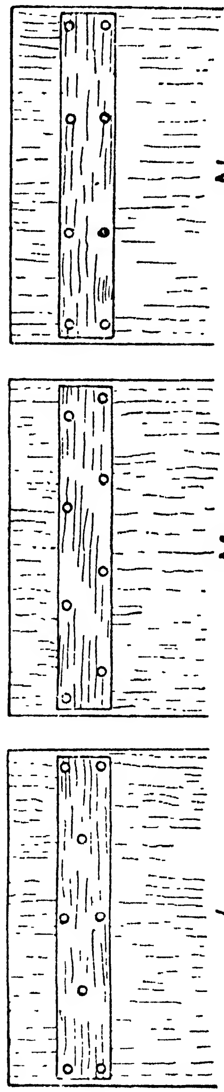


Fig. 40.—L.—Screws at Edges and Centre of a Batten. M.—Screws at Edges, but in different Lines of Grain in Board. N.—Screws opposite each other at Edges of Batten.

a few hours till the glue is hard. Glue is of no use for work exposed to the weather or kept in damp places, as moisture softens the glue and causes the work to come apart. Glue may be bought in liquid form or in cakes which have to be broken up and dissolved in hot water and used hot.

Joints.—In practically all woodwork it is necessary to join pieces together. Greater strength is obtained by doing so, and warping and shrinking are minimised or entirely prevented. A door, for instance, if made from a single piece of board would never keep true, and sooner or later would split. Therefore, even the roughest doors have cleats or battens screwed or nailed across them, and ordinary house doors are framed and panelled. By crossing the grain of two pieces we strengthen both. Another fact is that shrinkage is almost entirely across the grain, the length of a piece remaining practically unchanged in spite of considerable variations in width. These variations in width are much greater on a wide piece of wood than on a narrow piece.

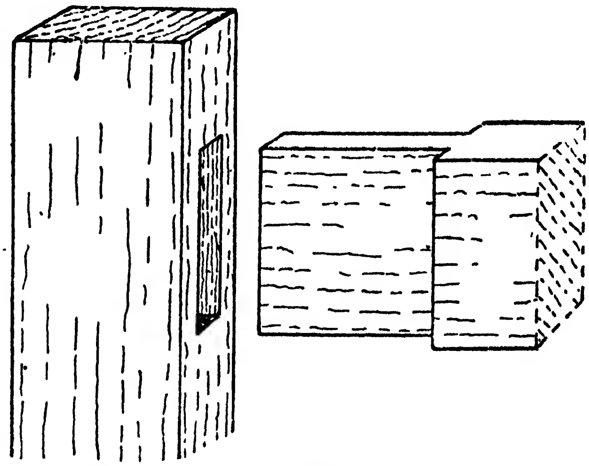


Fig. 41.—Ordinary Through Mortise and Tenon Joint.

Although screws, nails, or glue will hold two pieces of wood together with no more fitting than a plain flat surface joint, there is an immense variety of other joints designed to assist in the union and keep the parts in correct position. The kind of joint used in any particular case depends on the character of the work and the direction in which the strain occurs on the joint.

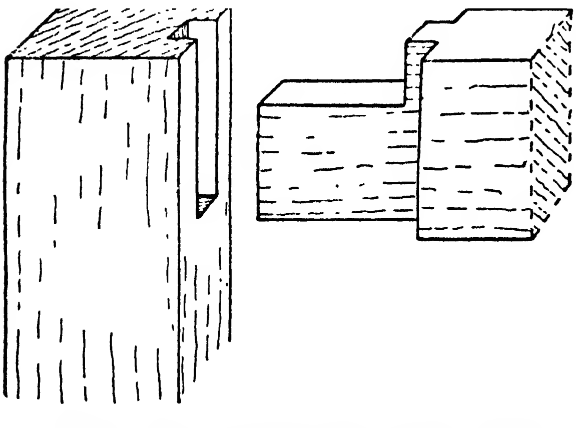


Fig. 42.—Corner Joint, with Tenon reduced in Width.

One of the commonest joints, though rather an elaborate one, is the mortise and tenon, Figs. 41, 42, 43, 44. It is the joint used in the frames of ordinary doors, and in a great variety of other work. The pieces are planed to width and thickness, and the positions and sizes of mortises and tenons marked with gauge and square. Tenons which go right through are generally glued and wedged, the mortise being cut tapering to receive a narrow wedge at

each edge of the tenon, the wedges being driven in from the outer end of the mortise and tenon. Occasionally tenoned joints are held by nails, pegs, or screws, put through from one side, but except for rough work this method is not much used.

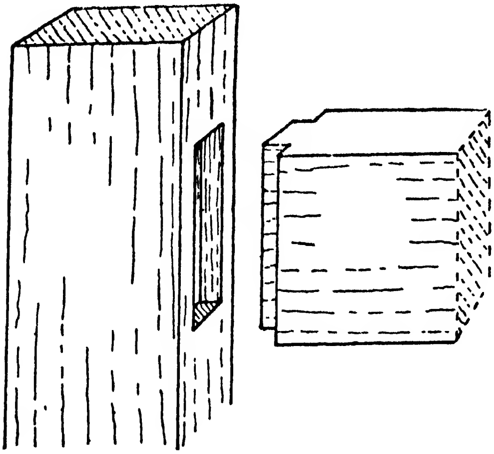


Fig. 43.—Stub Tenon, which does not go through.

Another type of joint which also brings the faces of the crossing pieces flush, or in the same plane as distinguished from fastening one piece on top of the other, is the halved or half-lap joint, Figs. 45, 46, 47. This requires screwing together. For some purposes it is as good as the mortise and tenon and is slightly less trouble to make. A tenon saw is used to cut down to the depth close to the shoulder, and then the wood to be removed is pared away with a chisel, or in large joints another saw-cut at right angles to the first will remove it bodily. A chisel and rebate plane are then used to finish exactly to the lines. Sometimes these joints are glued as well as screwed. Nails are hardly suitable because the parts are often not thick enough for secure nailing.

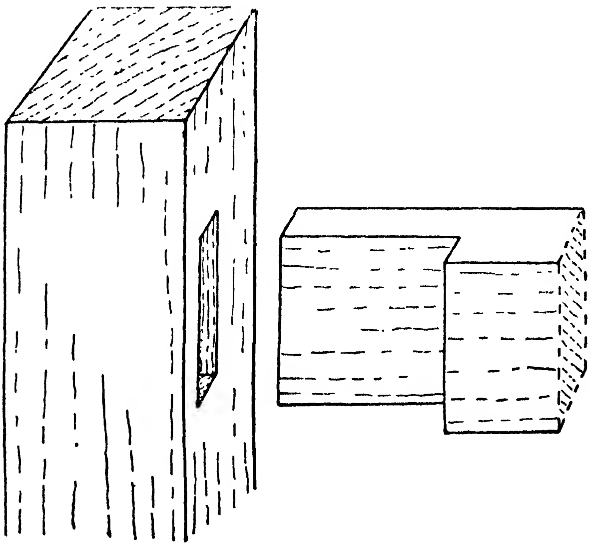


Fig. 44.—Tenon used where the Mortise Piece is thicker and the Parts are flush on One Face only.

Other varieties of framework joints at corners are shown in Fig. 48.

Joints in which the width is much greater than the thickness may be fitted together by the methods seen in Figs. 49 to 59. These are the kind of joints required in box-like constructions where the thickness seldom exceeds 1 in., but the widths may be so great that boards may have to be joined edge to edge to make it up. The simplest form of joint, not shown among these, is a plain butt joint where one piece is simply adjusted

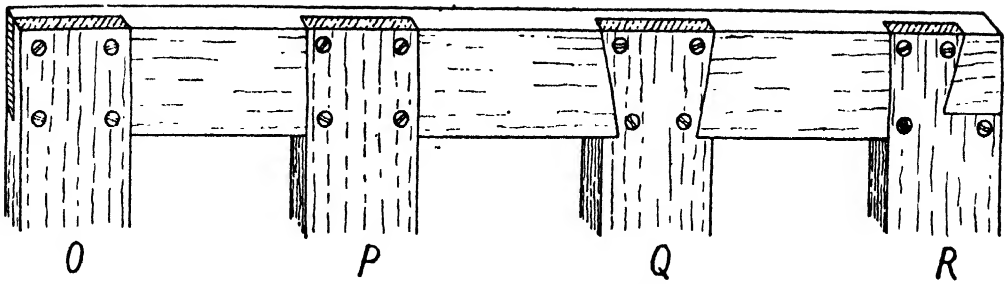


Fig. 45.—O.—Corner Joint with Parts halved. P.—Intermediate Joint. Q.—Dovetail Joint. R.—Corner Joint with a Dovetail.

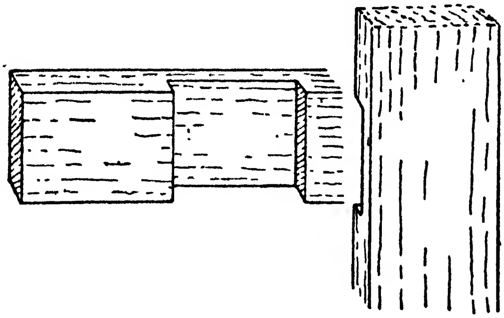


Fig. 46.—A Crossing Joint with the Parts halved.

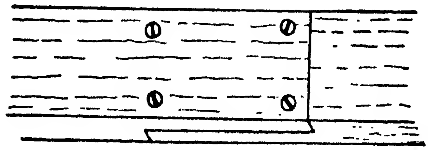


Fig. 47.—A Joint lengthwise with the ends halved together.

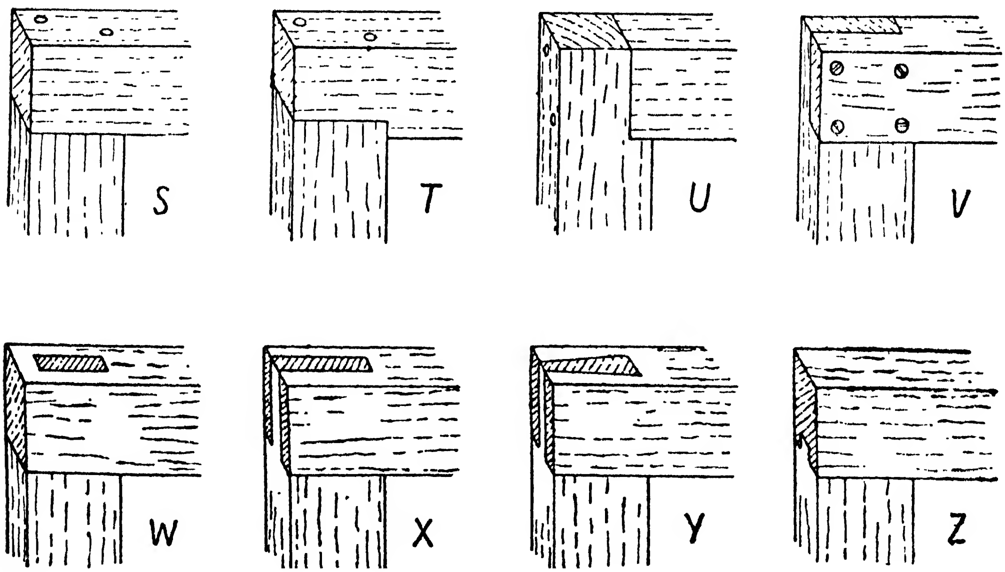


Fig. 48.—S.—A Plain Nailed Joint with Parts flush. T.—A Rebate to assist in keeping Parts in Position. U.—A Rebate the other way. V.—A Halved Joint. W.—Mortise and Tenon. X.—Open Mortise and Tenon. Y.—A Dovetail. Z.—A Stub Tenon open at One End.

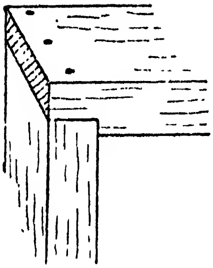


Fig. 49.—Rebated Joint in Carcass Construction.

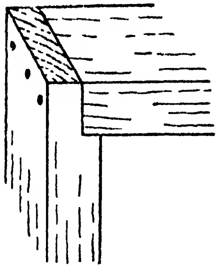


Fig. 50.—Rebated Joint, with Grain running right to top.

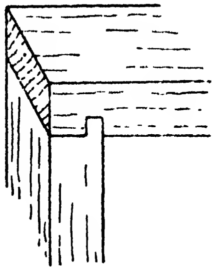


Fig. 51.—Tongue and Grooved Joint.

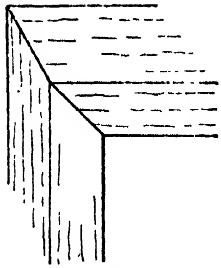


Fig. 52.—Mitre Joint, showing no End Grain.

flush with the edges of the other and nailed. Except in very neat cabinet work the joints shown are mostly nailed together and no glue

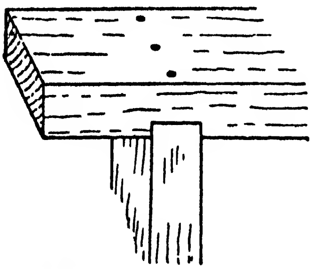


Fig. 53.—Rebated Joint at a Distance from End.

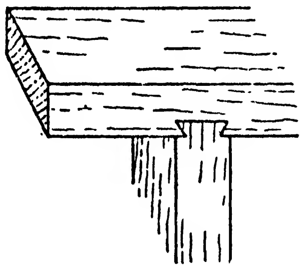


Fig. 54.—Dovetailed Rebate.

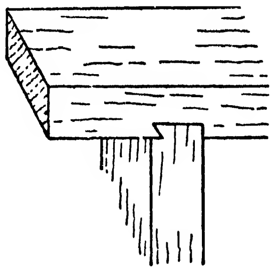


Fig. 55.—Rebate Dovetailed on One Side.

is used, exceptions being the mitre and the dovetail, which always are glued. The mitre, Fig. 52, is a weak joint which requires some-

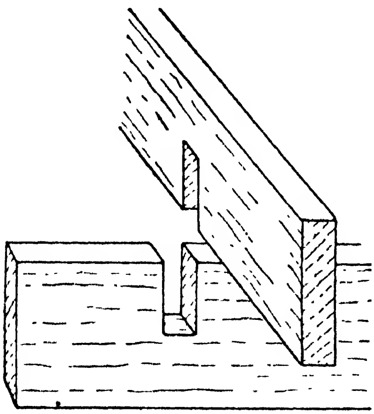


Fig. 56.—Halved Joint with Thin and Deep Pieces crossing.

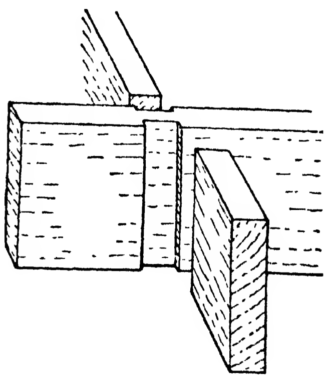


Fig. 57.—An Alternative Method to that of Fig. 56.

thing more than merely gluing together to make it reasonably secure. Sometimes fine nails are used in it or blocks of wood are glued into

the interior angle in cases where they can afterwards be concealed, or fine saw-cuts are made diagonally into the outer angle and thin slips of wood glued and driven in. There are also some variations in this form of joint which give more strength. Sometimes it appears as a mitre only along the outer angle and for a short distance in from the edges, the rest being some form of right-angle joint. Sometimes it is secret dovetailed.

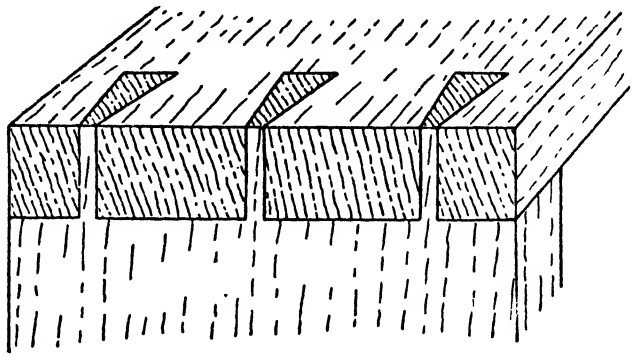


Fig. 58.—Ordinary Dovetails.

Dovetail joints, Figs. 58, 59, are the most complicated among those in common use, and an amateur needs practice before he can fit them neatly. They are used a great deal in cabinet work for boxes, drawers, and carcass construction. The important thing is to make a close fit, and this does not depend so much on accurate marking out as in careful transference from one to the other. Fig. 60 shows proportions generally adopted in marking out, the pins being three times the width of the spaces with a half dovetail

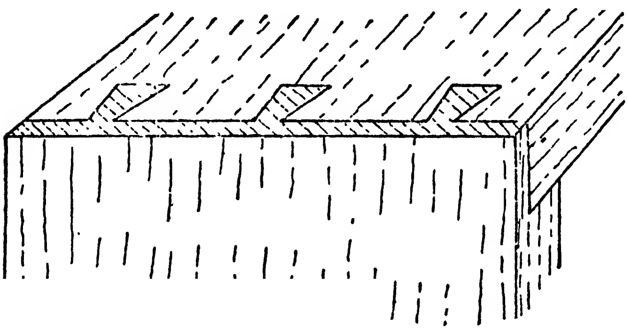


Fig. 59.—Lap Dovetails.

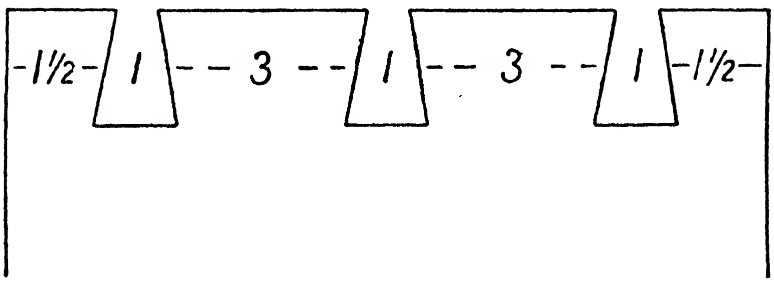


Fig. 60.—Dovetail Proportions. *Note.* The Figures indicate Proportions, not Inches.

at each end. Lines are gauged the correct distance in from the ends of each piece of wood, and then the divisions are made on a midway

line, and the angles marked in pencil for sawing to. The marking of the second piece is done by direct transference from the first, sometimes by a scriber after the spaces have been cut out, sometimes by marking with the saw guided in the first saw-cuts. After the saw-cuts are made

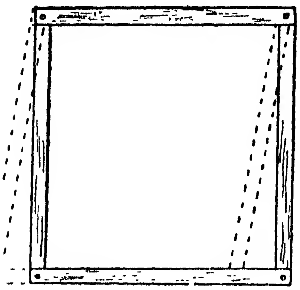


Fig. 61.—Dotted lines show how Slender Frame may Distort.

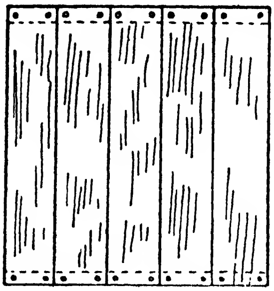


Fig. 62.—Rigidity of Frame obtained by Boarding.

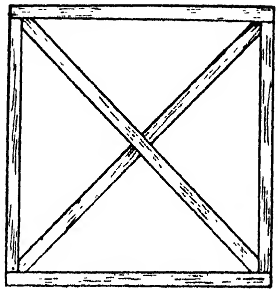


Fig. 63.—Rigidity of Frame, by means of Two Diagonal Braces.

from the end of the wood to the gauged line the wood to be removed is generally chiselled out, which in small dovetails is more expeditious than doing it with a saw.

Bracing.—An important feature in all large constructions is diagonal bracing to obtain rigidity. In small work the wood itself is solid and rigid, and shrinkage, warping, and the weakness of short grain are guarded against by judicious crossing of grain and jointing at right or

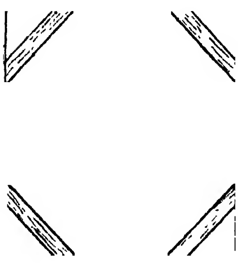


Fig. 64.—Rigidity of Frame by Short Corner Braces.

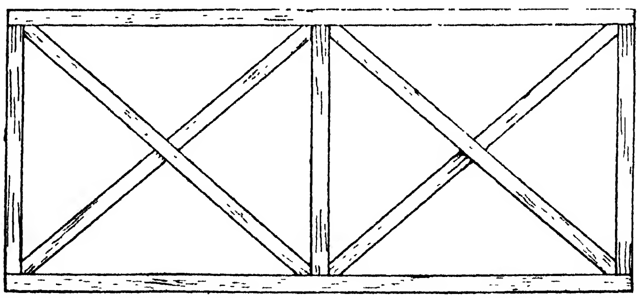


Fig. 65.—In Large Structures Frames are divided into Smaller Squares, each braced separately.

other angles to suit the shape of the article. But in large work it is more economical to brace in diagonal directions than to fill in with solid material, and in fact in addition to the latter diagonal bracing often increases the strength of the structure. Examples are shown in Figs. 61 to 65.

Boarded surfaces of large area are frequently necessary. In the neatest work it is done by means of panels fitting in grooves in the inner edges of skeleton frames, Figs. 66 and 67. In other cases a style of boarding

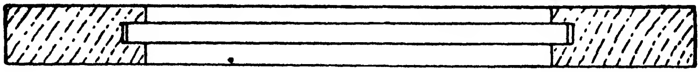


Fig. 66.—Section through a Panelled Frame.

is adopted which will not show open joints if the wood shrinks, examples of which are shown in Figs. 68, 69, and 70.

Grinding and Sharpening Tools.—All cutting tools require frequent sharpening to renew the edges worn and dulled by use. Grinding is

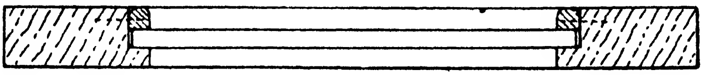


Fig. 67.—Panel fitted in Rebates and secured by Nailed-in Strips as an Alternative to ploughing a Groove.

the quick removal of steel for some distance behind the cutting edge, and sharpening is the production of a keen edge at the extremity. Grinding alone is not sufficient, because the edge produced by it is too coarse for cutting wood. The hone or oilstone used for sharpening will

Fig. 68.—Matchboard Joints; the Beads at the Joints render the effects of Shrinkage unnoticeable.

produce a keen edge on a narrow area of steel in a few moments, but it would be useless as a means of reduction on a large area.

Fig. 71 shows the difference between the ground and the sharpened portion of a chisel, and it applies equally to a plane iron. After the chisel has been sharpened a good many times the area which has to be rubbed down on the oilstone becomes so wide that sharpening takes a long time, and regrinding is necessary. It is a great advantage to have the means of grinding tools at home instead of taking them to a professional grinder.

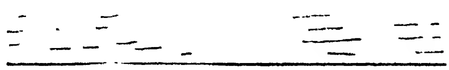


Fig. 69.—Weatherboard used for Outdoor Work.

For use at home there is nothing better or cheaper than one of the hand emery grinders, Fig. 72. It can be turned with the right hand while the tool is held in the left, or if there is another person to turn

the handle, the one who is grinding the tool can have both hands free for the purpose. The wheel is used without water, and the tool must press lightly or it will become overheated.

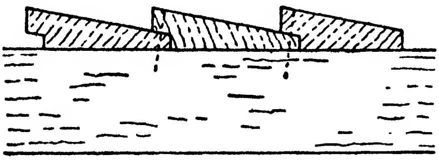


Fig. 70.—Rebated Weatherboard.

Oil is used on the oilstone to take up the abraded particles of steel and stone and prevent clogging and glazing of the surface. The chisel, or other tool, is rubbed backwards and forwards with light pressure along the stone, tilted very slightly higher than the grinding angle, Fig. 73. A trace of burr on the other face is removed by a few light strokes with the chisel lying flat. Oilstone slips are used for tools with faces which cannot be dealt with conveniently on a flat oilstone.

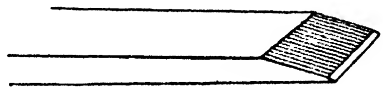


Fig. 71.—Cutting Edge of Chisel showing Sharpened Extremity as distinct from the Ground Bevel.

Saws are sharpened by filing the teeth, and unless the user studies them and has some amount of practice it is difficult to obtain accurate results. A special vice for holding the saw is almost essential. Besides sharpening it is necessary to set the teeth occasionally, that is, to keep them properly bent slightly to alternate sides so that they will make a cut wide enough for the blade to follow without severe friction. There is not space here to go into details about sharpening saws, and, as a saw not in constant use seldom needs attention, it is generally best for the home worker to take it to a saw sharpener when it gets dull. Its edge becomes spoilt immediately if it is allowed to come in contact with nails when sawing old wood.

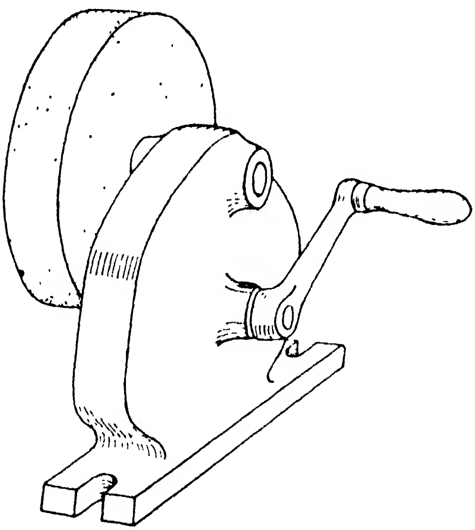


Fig. 72.—Hand-operated Emery Wheel Grinder.

Glass-papering and Finishing.—After the work with cutting tool is done, and the parts assembled, there is often further work to do in glass-papering, painting, staining, varnishing, or polishing. Rough work does not receive any of this treatment, but, even for outdoor structures where fine finish may not be important, the wood can be protected and its durability increased by the use of paint or tar. Indoor articles are often left untreated, as, for instance, the tops of kitchen tables.

Wood is glass-papered to remove tool marks. Even the cuts taken by a plane can be seen if the surface is viewed from a suitable position and would look bad if allowed to remain on furniture. The marks made by chisels and gouges are much more noticeable. All these are levelled by the use of glass-paper or in some cases by scraping with a thin piece of steel called a scraper, which has sharp square edges. Glass-paper is generally used wrapped round a block of wood or cork, which is a convenient way of holding it, and gives better results than is possible with the hand alone. To avoid scratches it should be worked in line with the grain, or the finishing strokes should be with the grain.

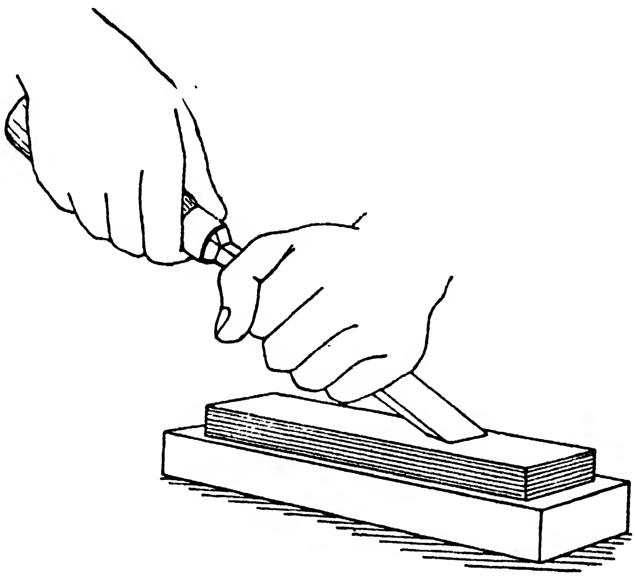


Fig. 73.—Showing how a Chisel is held for Sharpening on an Oilstone.

Varnish or polish gives a more glossy surface than paint, and is used for most indoor articles. The grain of the wood shows through it. Varnish or polish consists mainly or entirely of shellac dissolved in methylated spirit. At least two coats are necessary to get a glossy surface, and the first is rubbed down with fine or worn glass-paper before applying the next. A varnished surface is done with a brush, but polishing is done with a rubber, and requires more skill. Stain is used to change the colour of the wood, and may be applied before varnishing or incorporated with the varnish.

ADJUSTABLE ARM-CHAIR

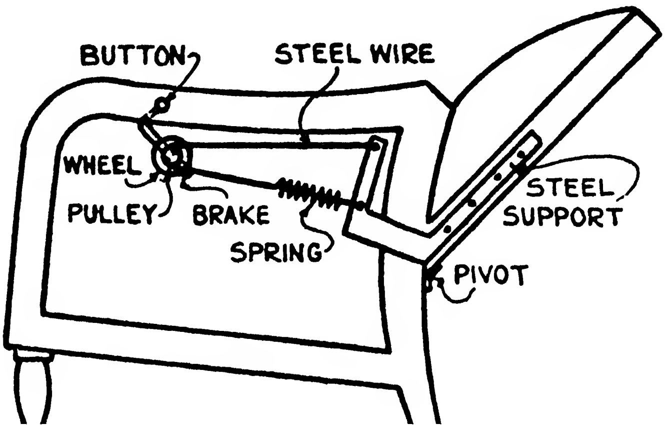
Any ordinary arm-chair can be rendered self-adjusting by fitting the concealed mechanism described and illustrated here.

A pivot is fitted to the back of the chair, and to each side is fixed a steel support in the shape shown in the diagram. The free end of this support has a steel wire attached which passes over a pulley and joins a spring which is fixed to the lower end of the support. This spring tends to raise the back of the chair; this movement is stopped, at any desired position, by a bar which acts as a brake on the rim of a wheel attached to the pulley wheel.

The movement of the back is effected by pressing a button, hidden in

the arm of the chair; this releases the brake on the wheel, and the spring comes into action and the back of the chair is raised. There are naturally two similar mechanisms, one on either side of the chair.

When the chair is in a normal position and an inclined position is desired, all that is necessary is to press the buttons simultaneously and



A Self-adjusting Arm-chair.

allow the occupant to recline against the back of the chair; when the back has reached the desired position the buttons are then released and the brake acts on the wheel and the back becomes fixed. To raise the back from an inclined position, all that is necessary is to release the brake and the spring pulls the chair into the normal position.

ARM-CHAIR, CONVERTIBLE TO OCCASIONAL TABLE

A very convenient article of furniture for the drawing-room, where perhaps there is only a slight demand for a table, is shown here in the form of an arm-chair which can be converted instantly into a table just sufficient in size for occasional purposes. It is simple in design, consisting of straight timbers throughout.

The rear face of the back is made to function as the table top. When used for the chair, as shown in Fig. A, the circular ends of a cross-member B (Figs. D and C) engage in the rear ends of specially designed tracks A, and a bottom cross-member C drops into a suitable notch provided in a block attached to the inside of the frame. From Fig. D it will be seen that, for the chair position, the two pairs of projections merely drop into the notches referred to, while for the table position the back is lifted out of the notches and swung over (as shown in Fig. C), projections B travelling along to the other end A of the track. Support for the

table top is obtained by the ledge D, forced integral with the front legs.

In order to produce a suitable surface for the table a piece of three-ply

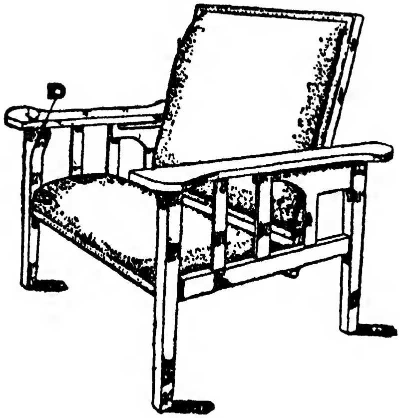


Fig. A.—As an Easy Arm-chair.

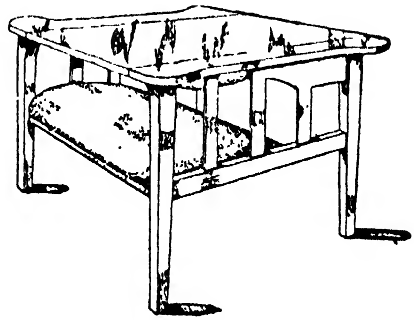


Fig. B.—As an Occasional Table

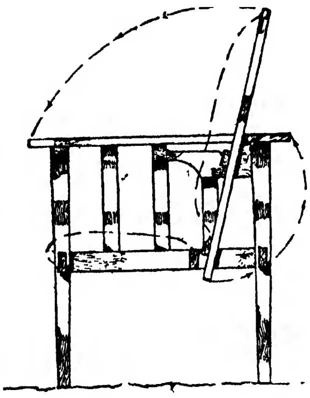


Fig. C.—The Chair shown in Section.

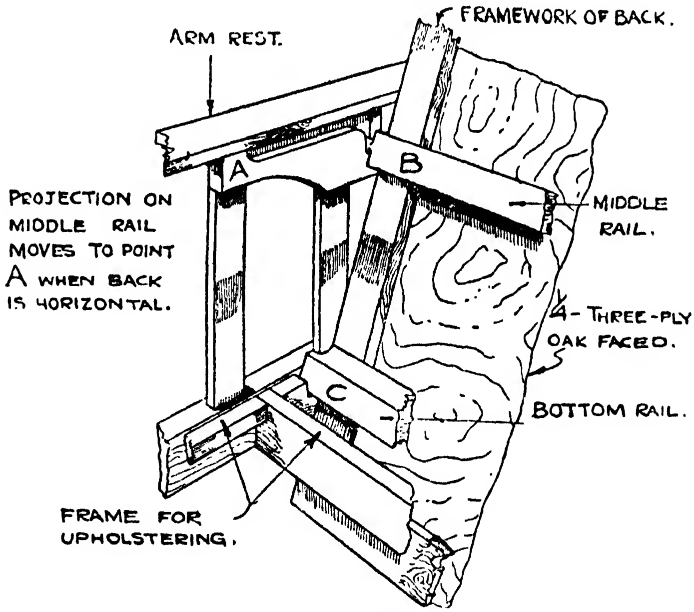


Fig. D.—Details of Back Locking Method.

oak face $\frac{1}{4}$ in. thick supported on a framework of 2 by $\frac{3}{4}$ in. oak will give all the necessary rigidity. The appearance of this article of furniture is indeed pleasing, especially when produced in dark oak with russet-coloured rexine for the upholstering.

BEDSTEAD, CABINET TYPE

The combination bedstead and cupboard, of which views are shown in Fig. A, should prove particularly useful in the modern small flat where economy in space must be exercised. For a room which must serve both for living-room by day and bedroom by night, the neat appearance of the closed cupboard is a great advantage—while in the ordinary household the use of the bedstead for accommodating the occasional visitor will be obvious.

The construction has been kept as simple as is compatible with a sound, workmanlike job. The actual bedstead and cupboard have been kept

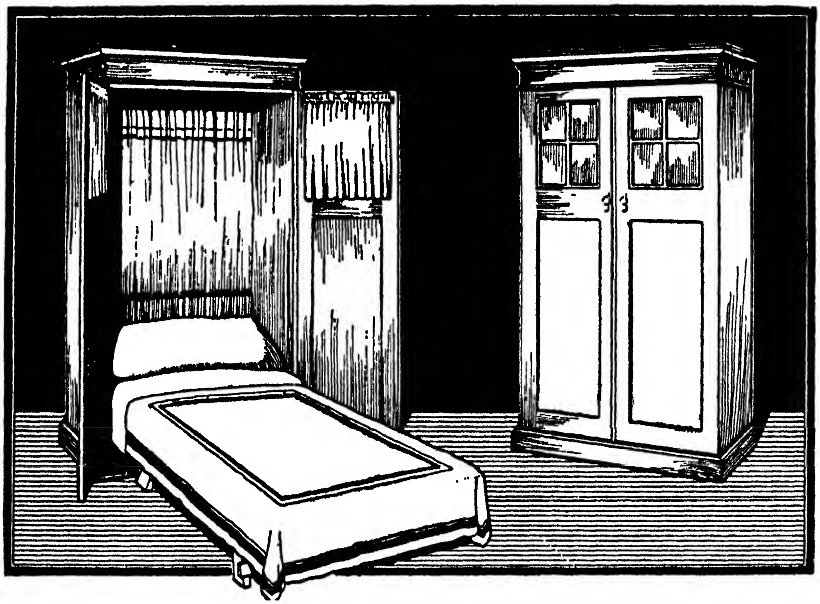
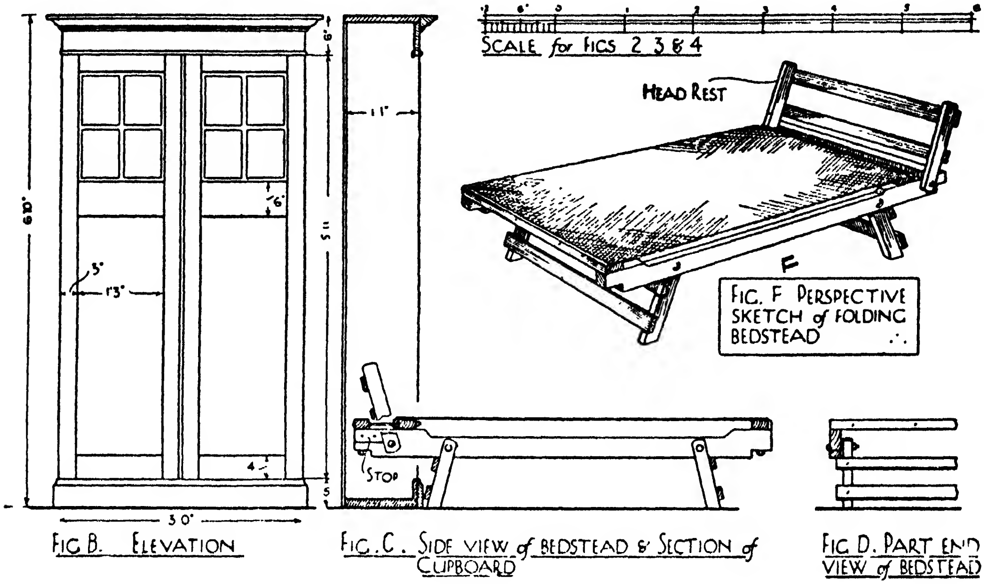


Fig. A.—Showing the Cabinet Bedstead Open (left) and Closed (right).

separate, which is thought to be the better arrangement in a confined space, when the bedstead can be placed in the most convenient position, not necessarily as shown, with the head in the cupboard.

Making the Bed Frame.—The framework of the bed is shown in Figs. B and F. The basis of this is the ordinary single-size (2 ft. 6 in. to 3 ft.) wire mattress. To this are fitted (as shown in the elevations, Figs. C and D) two leg sections and a head rest. The uprights of these parts could well be of 2 in. by $1\frac{1}{4}$ in. material and the cross-rails of $1\frac{1}{2}$ in. by $\frac{5}{8}$ in., projecting about $\frac{1}{2}$ in. beyond the legs. The width between the legs should be about $\frac{1}{8}$ in. less than the width of the inside of the mattress frame. These leg struts are fitted to the frame by means of a $\frac{5}{8}$ in. bolt, arranged so that the struts rest at about the angle shown in the elevation. The

head rest is constructed in much the same manner as the leg struts and is bolted to the mattress frame in a similar fashion. The perspective sketch, Fig. F, should make this clear.



Dimensions and Constructional Details of Cabinet Bedstead.

The Cupboard.—The sizes for the cupboard will naturally depend upon the size of the spring mattress frame that is used. The inside of the cupboard should be 6 in. wider than the frame, and tall enough to contain easily the folded bedstead. The timber used will depend upon the taste and pocket of the worker. If possible, however, a hard wood should be used—oak, walnut, or mahogany; failing these, birch or American whitewood will make a good job and can be well finished.

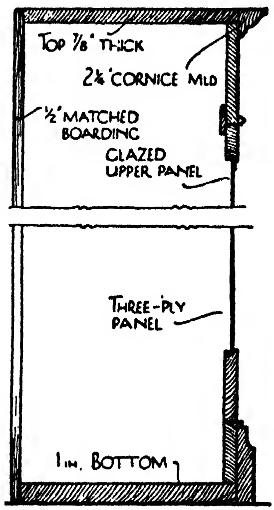


FIG E. SECTIONAL DETAILS

The two sides finish 1 in. wide by $\frac{7}{8}$ in., and the top and bottom, of about the same thickness, are dovetailed into them. The back can best be of $\frac{1}{2}$ in. or $\frac{3}{8}$ in. matchboarding; for a better job, a panelled back with plywood panels would be suitable. A $2\frac{1}{4}$ in. cornice mould is planted round the top with a $\frac{1}{2}$ in. astragal moulding $2\frac{1}{4}$ in. below it, forming the frieze as shown in the enlarged sectional view. The doors are framed up of $\frac{3}{4}$ in. stuff, the upper portion being glazed and the lower filled with a plywood panel. The apparent division of the glazing into four small panes can be

quite easily and effectively carried out by applying a plywood fret to the surface of the single sheet of glass. With curtains arranged behind the glazed doors and at the back of the cupboard, this part of the work will be completed.

If it is desired to keep the bed made up and ready for use, the bed-clothes should be securely strapped to the mattress and the whole folded and placed within the cupboard.

BEDSTEAD, CAMP

The camp bedstead described here will present few difficulties in construction.

Figs. A, B, and C show the complete bedstead, with canvas omitted. It folds up so that it can be used as a seat, the head-board being hinged to turn down on top of the legs. This board has a strip near the front of its under surface to fit over and keep the upper ends of the legs together, and it should be held down by a hook and eye (not shown) in the centre of the strip or one near each end of the head-board, so that the board cannot be accidentally lifted and release the closed legs. The wood used is generally beech or birch, but other hard woods or ordinary deal would do, the latter requiring slightly stouter legs. Dimensions are given on the figures. The swivel joints of the legs are made with $\frac{1}{4}$ in. rivets. Three $\frac{1}{4}$ in. holes are bored through each of the legs, one being midway in the length and the others $1\frac{1}{2}$ in. from each end. It will be seen in Fig. A that exceptions occur at the head and foot, where the upper ends of the legs are united by rigid cross-pieces. The latter are for the attachment of canvas, and the head-board also is hinged to one of them. The rivets are put through the holes with a washer under the head of each rivet, another between the legs where they cross to form a joint, and a third on the end of the rivet before hammering up. Except at head and foot the outer set of legs are plain strips with rounded ends. The inner set of legs are framed in pairs as in Fig. D, angle brackets being used to prevent distortion. The lower ends of the legs at each end of the bedstead are united $3\frac{1}{2}$ in. up from the bottom by ties of the same cross-section as the legs, fitting with round tenons into bored holes in the legs and secured by glue and a wedge in each tenon. One of these can be seen in the end view of the folded bed-stead. The canvas should have a 2 in. hem round its edges and is attached to the wood by screws with metal and leather washers under their heads to keep them from tearing through the canvas, the metal of course being next to the screw-head and the leather next to the canvas. The holes through both should just fit the screw. The canvas should be attached with the bedstead extended. A row of screws 4 in. to 5 in. apart are put into the top cross-rails of head and foot and then a screw into each of the inner legs near the top. The head-board is hinged as seen, and can, if preferred, be kept in a more upright position on the open bedstead by attaching a length of webbing at each side. In Fig. A it is back to the fullest extent which the hinges allow.

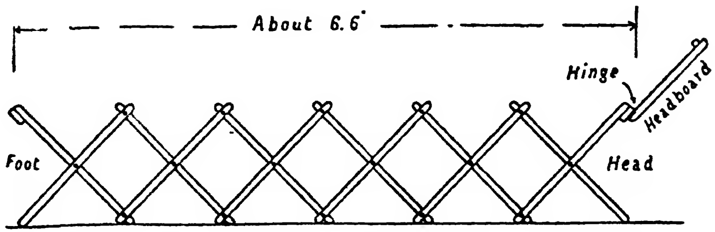


Fig. AA Side view of bedstead, open, with canvas top omitted

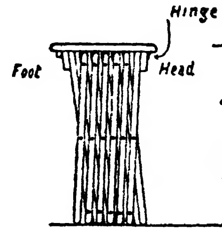


Fig B.
Side view of bedstead closed

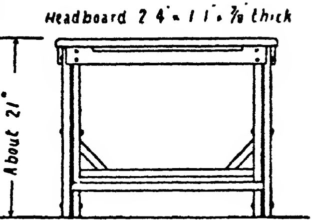


Fig. C.
Bedstead viewed from foot end when closed

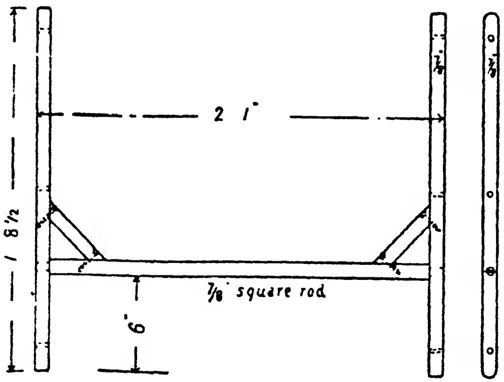


Fig. D
One of the inner frames

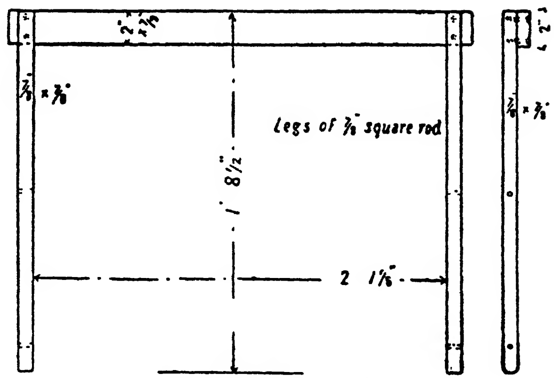


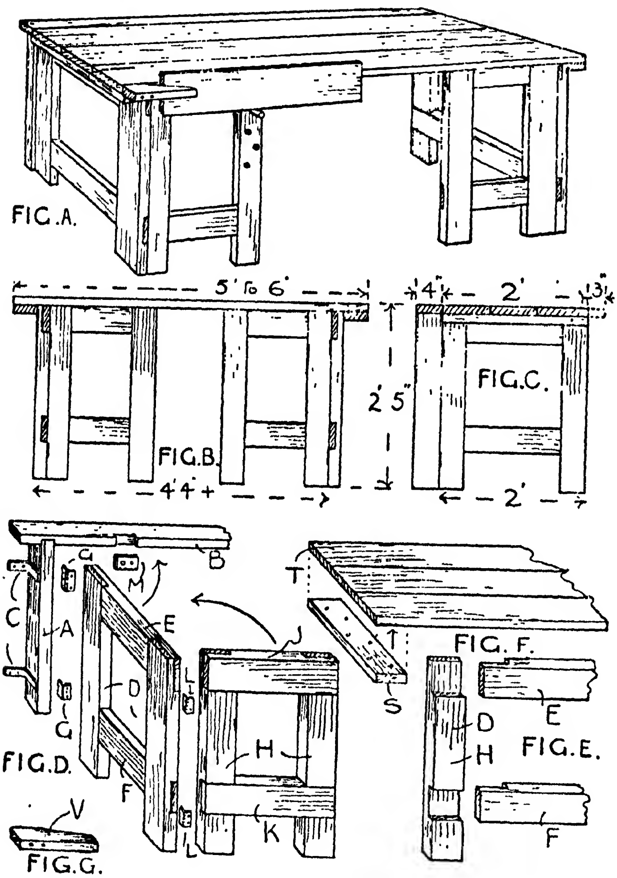
Fig. E. Outer frame at head

Illustrating Method of Constructing Folding Camp Bedstead.

BENCH FOR WOODWORKERS

The folding bench shown in Fig. A is an improvement on the ordinary shelf bench with two hinged supports, and does not take up any more room.

The main dimensions are given in the front and side elevations at Figs. B and C and the construction is shown in detail at Fig. D. The length of the top can be anything from 5 ft. to 6 ft., or even longer, but the width should not be more than 2 ft.; this, with the space at the back, gives a total width of 2 ft. 4 in., quite enough for all ordinary work.



Constructional Details of Folding Bench.

Materials Required.—The material used should be fairly stout; 4 in. by 2 in. deal planed all over at the timber yard will not be too stout, but a satisfactory bench can be made with 3 in. by $1\frac{1}{2}$ in. stuff; less than this is not advisable, although the two inner boards of the top may be of 1 in. thickness.

Back Supports.—Begin by providing the back support; two uprights, A, are housed into a top rail, B. Presuming that 4 in. by 2 in. wood is used, the uprights are housed in 1 in. deep, 4 in. from each end. The uprights are secured to the wall by iron brackets, as at C, two on each side and either two or three on the top.

Main Supports and Frames.—The two main supports are of 4 in. by 2 in. uprights D, with two rails E and F, the latter being plainly housed or half-dovetailed into the uprights to give a width of 2 ft. Mark off the uprights to the height from the floor to the under side of the top rail B,

and then mark out and cut the joints as shown in the separate detail at Fig. E. When the other frame is done, the frame just completed is hinged to the inside of the leg by back-flap hinges as at G, so that the front of the frame, when hinged, is flush with the front edge of the upright, thus leaving a space of 2 in. behind and between it and the wall. The second lot of frames are made from the same material with two uprights, the same height as the others, as indicated at H, having two rails J and K, housed in as before, the latter being not more than 2 ft. long, thus providing a frame that will fold back on hinges as at L.

Although there is no need to let in the back-flap hinges which attach the first frame to the uprights, it is necessary here to have the hinges close up so that the width of the two frames does not exceed the total width of the top rail B; ordinary iron or brass butts can be used, a length of 2 in. being enough. The sets of hinged legs should be fitted on and tested before the top is made, and if when folded back they fit neatly in the framework, the top, as shown at Fig. F, can be made. If thinner wood is used at the back, as at T, to make up the width to 2 ft., it will be necessary to provide a cross-piece at each end to make up the total thickness to that of the front piece, which should be $1\frac{1}{2}$ in., or at least $1\frac{1}{4}$ in. If a recessed back does not matter, the thinner boards can be used without packing.

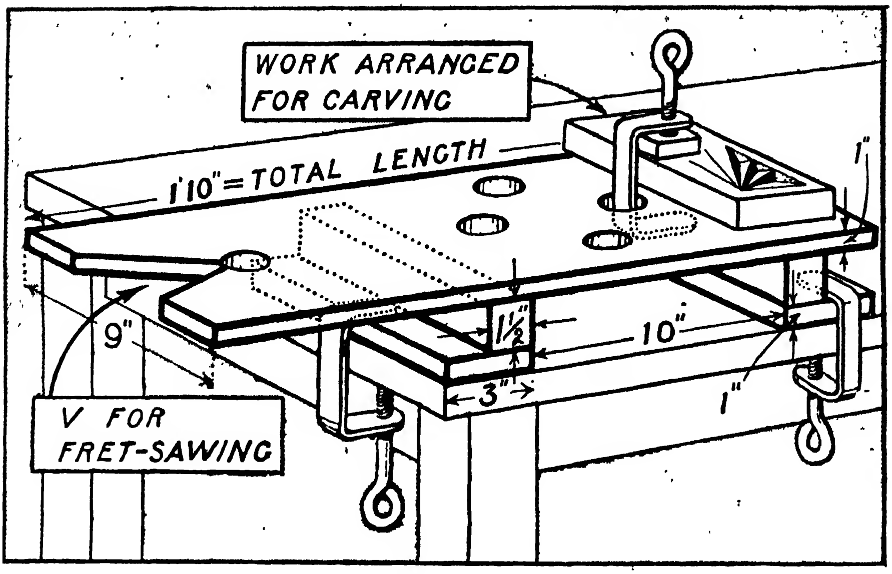
Bench Top.—The three boards selected for the top are now screwed to two end battens as at S; this piece should be 4 in. by $1\frac{1}{2}$ in. The top is now hinged with 2 in. or $2\frac{1}{2}$ in. iron or brass butts to the back rail B, as at M.

It will be seen at Fig. G that the piece of wood, measuring about 12 in. by 3 in. by $1\frac{1}{2}$ in., has one corner sawn off, the wood being marked 2 in. on the end and 8 in. along the side, the sawn surface being planed smooth. Two holes are now bored in the parallel end to take 4 in. screws, these being let in $\frac{1}{2}$ in. so as to give a good hold. Holes are now bored in the front of the frame, as shown at Fig. A, to take a peg about $\frac{3}{4}$ in. diameter. In use, the board to be planed is pushed into the angle and rests on a peg placed in a convenient hole as shown at Fig. A.

BENCH, FRETWORK AND WOOD CARVING

The combined carving and fretwork bench shown in the drawing is simple to make and will be found useful to those who wish to combine carving with fretwork.

The construction is quite evident from the drawing and needs no lengthy description. Birch is the best wood for the top, but red deal may be used, provided a sound piece be chosen. This wood may also be used for the supports underneath. Plane the wood to the sizes shown. Drill the five holes through the top with a $1\frac{1}{4}$ in. centre-bit. Saw out the V, and then screw together, taking care to countersink the screws below the surface of the bench top.



A Useful Bench for Fretwork and Wood Carving.

The drawing shows quite clearly how the bench is fixed to a table when in use, and also how a piece of carving is held in position.

BENCH, UNIVERSAL PORTABLE

The bench described and illustrated in Figs. A and B was designed for small workshops with little space to spare.

It consists of a collapsible woodwork bench. Two cabinets are hinged one above the other to the back of bench; these convert the bench into a metal-working bench and a drawing bench at will.

The Bench.—The legs of bench are made in pairs connected together by removable rails wedged into taper mortises.

The bench top consists of three lengths of 8 in. by 2 in. deal; the edges should be carefully planed and glued together. Three 4 in. by 1 in. battens are next screwed underneath, the end ones fitting outside leg tops. A patent bench stop should be fitted, also a "Record" adjustable woodwork vice.

First Cabinet.—When raised it displays an assortment of woodworkers' tools arranged in suitable clips; when closed down it forms a metal-working bench 3 ft. by 2 ft. complete with vice.

The construction is as follows:

The back is fixed to bench top by two thumbscrews; at each end are fixed two triangular pieces to strengthen the back, and two brackets at rear take the weight of cabinets when raised; the sides and front are joined by tongued mitres as per illustration, the top edges are rebated on the outside, and the top is grooved to fit over same.

The top boards are planed off and treated the same as main bench top and glued and screwed on to sides.

Six in. by 1½ in. material should be used for the top.

The vice should be about 3 in. or 4 in. jaw size, preferably swivelling.

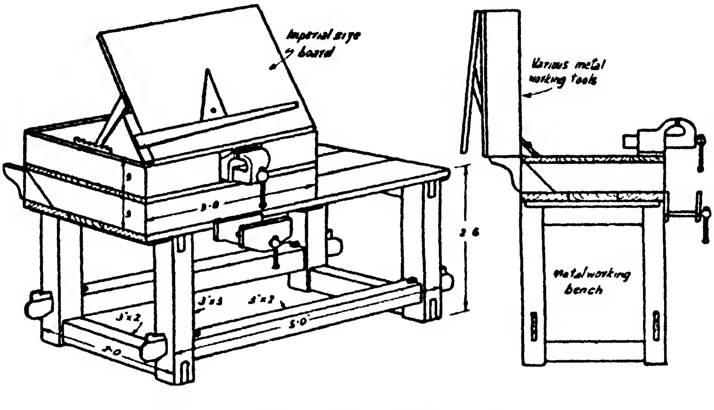


Fig. A.—A Universal Portable Bench.

Second Cabinet.—The second cabinet when open keeps metal-working tools to hand, and should have a vacant space left to fit over vice when closed down. The construction is the same as first cabinet, only of lighter material, ¾ in. stuff being amply strong. To the back of this cabinet is hinged an imperial size drawing-board. The total height of board edge from floor is approximately 4 ft., and metal vice 3 ft. 9 in. or so.

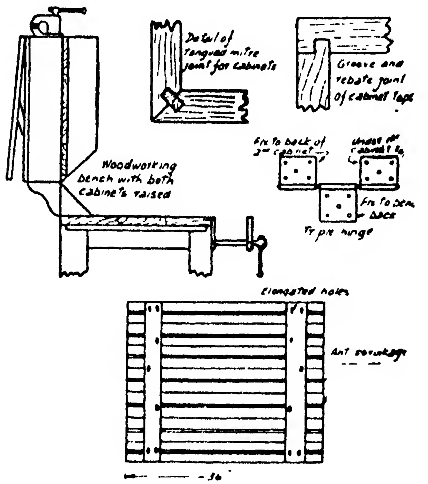


Fig. B.—Constructional Details of Portable Bench.

Drawing-board Construction.—The drawing-board should be made of good pinewood 3 in. by ¾ in. strips, carefully planed and glued together: each strip has a ¼ in. deep groove cut in the middle of it. This reduces shrinkage to a minimum. Two 3½ in. by ⅝ in. oak ledges are screwed to the back of boards, the screw holes being fitted with elongated brass washers, which allow shrinkage without straining. A strip of ebony should be glued into a rebate on the left edge for the T-square to slide along; when fixed it should be cut through level with each groove.

The board should be hinged on to top cabinet front edge by the oak ledges, also two adjustable supports should be fitted behind the board. A bench constructed on these lines will amply repay the construction.

BLACKBOARD, MAKING AND PAINTING

The following formula for painting is the result of an expert's many years of experience of painting in all branches.

After well coating with ordinary lead colour, glass-paper down, and

apply good ivory or bone black ground in turps, made fairly thin with japan gold size, and thickened to working consistency with finest grade pumice-powder. This not only forms an excellent surface to receive the chalk, but, what is equally important, withstands the process of rubbing out, and in this latter respect excels emery powder, as given in some recipes. Emery would also tend to wear away the chalk unduly, and is far too heavy to mix with ordinary pigments successfully.

BOOKCASE AND DESK, COMBINED

The fitment illustrated herewith can be made in oak, stained and polished, or in cypress, stained and polished or stained and varnished.

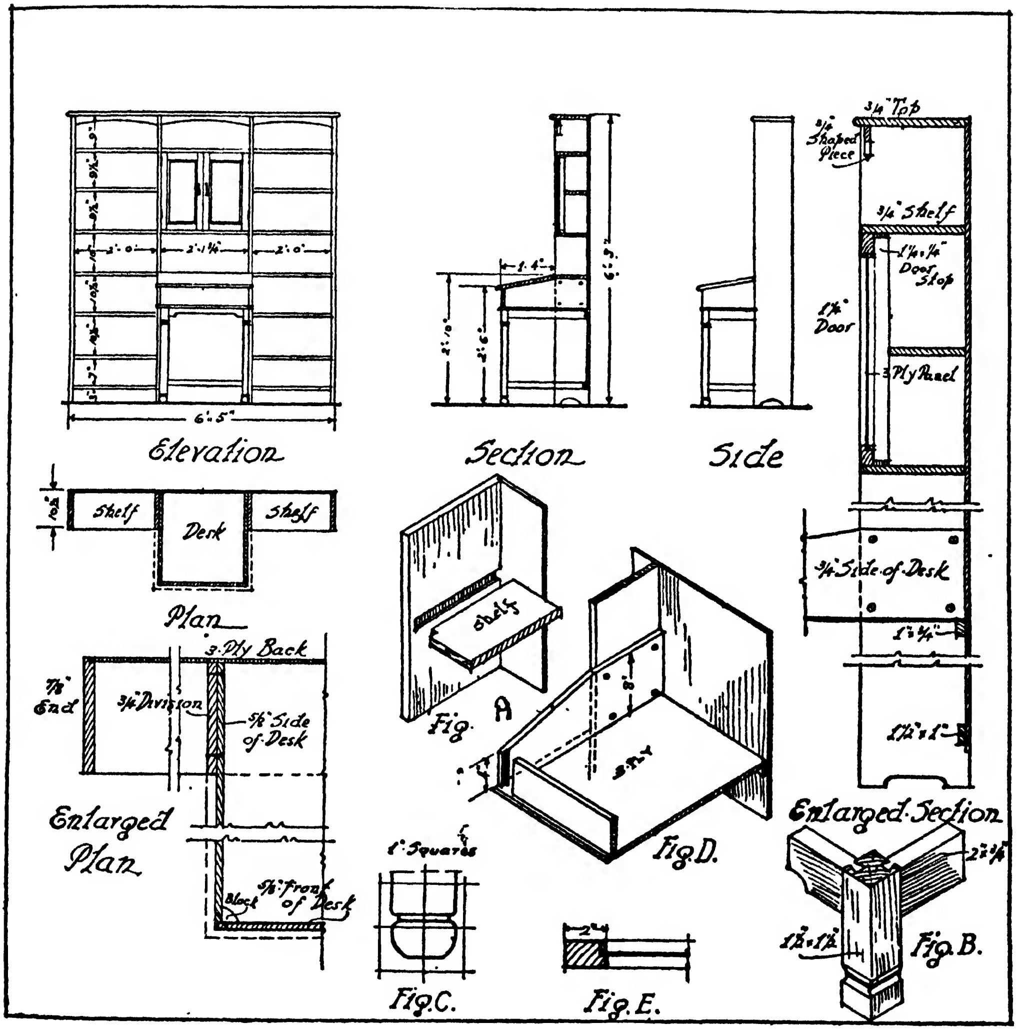
With regard to construction, the ends of the bookcase are $10\frac{1}{2}$ in. broad by $\frac{7}{8}$ in. thick, whilst the divisions are of the same breadth by $\frac{3}{4}$ in. thick. These ends and divisions are raggled to take the $\frac{3}{4}$ in. thick shelves, as shown at Fig. A, the ends being rebated also on the back edge to allow of the 3-ply back being fitted into the rebates, as illustrated in the enlarged plan, and at Fig. A. The top is $\frac{3}{4}$ in. thick, rounded on edge and rebated on the back edge for the 3-ply back, as can be seen from the enlarged section. The top can either be screwed to the ends and divisions, or the latter can be raggled into the top—this, of course, being the better job. At the front, under the top, are fitted shaped pieces, $\frac{3}{4}$ in. thick, as shown. A small cupboard is formed in the centre division, the door being made $1\frac{1}{4}$ in. thick and in two leaves, with stiles and rails 2 in. broad according to detail furnished at Fig. E. It will be necessary to fit a $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. door stop round the inside of the door opening, this being shown on the enlarged section. Note that at the back of the desk in the centre division, a $1\frac{1}{2}$ in. by 1 in. rail is fixed between the two divisions, so that the 3-ply back can be secured at this part. The bottom of this rail should be 4 in. above the floor, so that it will be level with the bottom rails of the desk.

Showing Completed Combination Bookcase-desk.

The desk is set on two legs, each $1\frac{1}{2}$ in. square, with feet moulded similar to that illustrated at Fig. C. The rails at the sides and front immediately under the desk are 2 in. by $\frac{3}{4}$ in., and are dovetailed into the legs as in Fig. B, and screwed to the inner face of the divisions. The bottom rails are $1\frac{1}{2}$ in. by $\frac{3}{4}$ in., tenoned into the legs and screwed to the divisions as before. The desk is framed up with two shaped ends, each $\frac{5}{8}$ in. thick, screwed to the inner face of the divisions and rebated on the front edges to take the front piece of the desk. The front piece is $\frac{5}{8}$ in. thick, fitted and screwed into the rebate on the ends, the corners

being strengthened by means of a pared block, glued into the angle. The construction of the corner is shown in the enlarged plan.

The bottom of the desk is of 3-ply, screwed to the ends and front, and also to a 1 in. by $\frac{3}{4}$ in. fillet along the back. The method of constructing



Dimensions and Constructional Details of Combination Bookcase-desk.

this part of the fitting is shown in Fig. D and in the enlarged section.

The lid of the desk is also $\frac{5}{8}$ in. thick, rounded on edge, the head piece on the top being screwed to the two side-pieces and the opening part hinged to the former with brass hinges. A lock will be required for the desk, and cupboard turns with drop handles, along with two small flush bolts for the cupboard door.

The fitting when built will make a handsome piece of furniture, and although it looks a big job, it will be found in actual practice to be very easily made, no difficult jointing being necessary.

BOOKCASE WITH DRAWERS

The modern taste in furnishing has made a clean sweep of the heavy, towering pieces of the Victorian period and the years following, and the

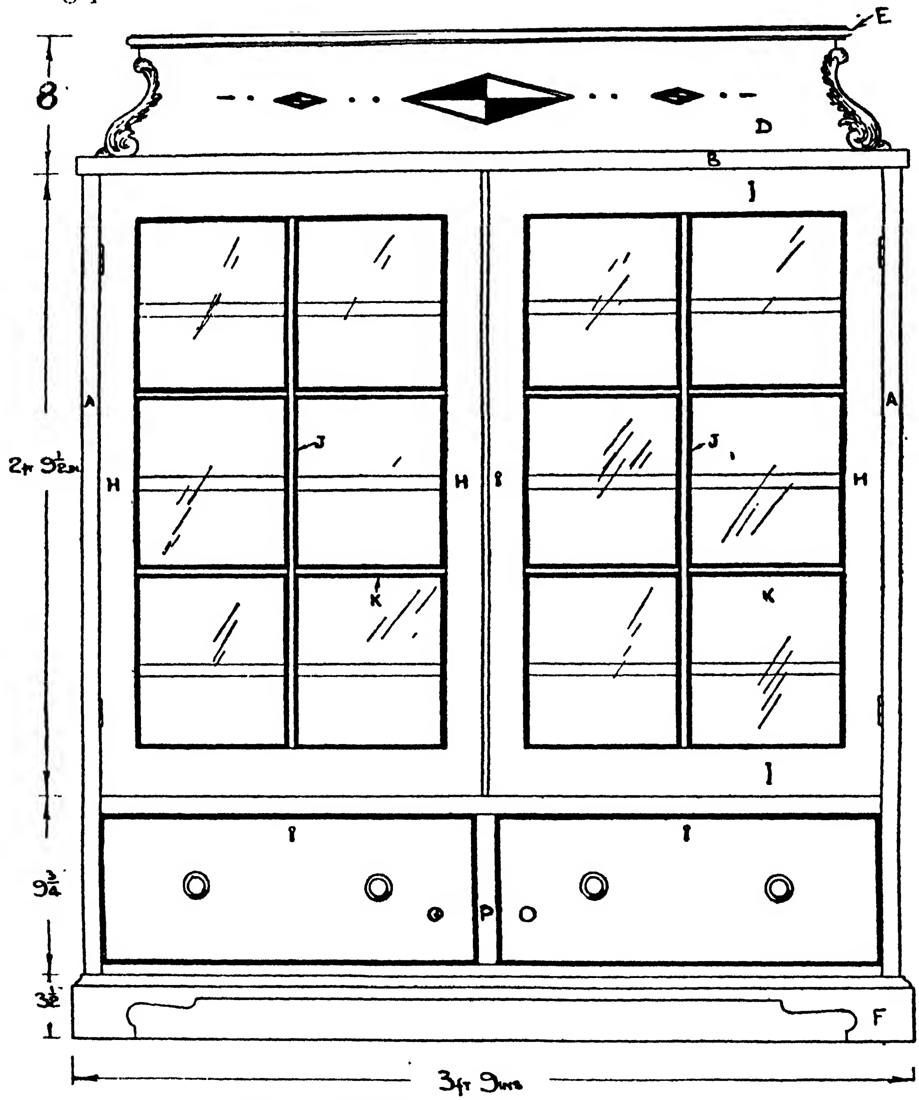


Fig. A.—Showing Bookcase with Drawers below.

tall bookcases, so far as home and office furnishing are concerned, are things of the past.

Deservedly popular is the dwarf bookcase, with its shelves so easy

of access. In the modern home a height of 4 ft. 6 in. or 5 ft. is the limit for sideboard, buffet, curio cabinet, or bookcase, and a sense of spaciousness and refinement in quite moderate-sized rooms is thus obtained.

The bookcase illustrated is in harmony with the tendency of modern design. Simplicity and restraint are exemplified. Good proportion, a freedom from meaningless ornament, a direct and ruthless adaptation of the design to the definite uses for which the article is required, characterise it. It follows no particular tradition, but makes no bizarre attempt to break with tradition.

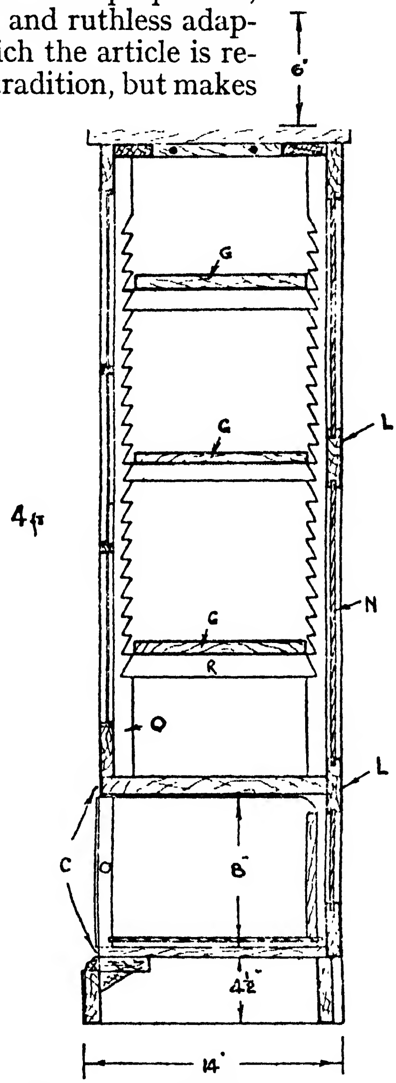


Fig. B.—Side Sectional View of Bookcase with Drawers.

Material.—The medium may be oak, finished fairly light in colour; Italian or French or English walnut, to be oiled and waxed a natural colour, or indeed any hard wood that is sufficiently light to contrast with the black beading round the drawers and glass doors, and the jet-black ornaments, which may be regarded as optional. Even in mahogany the bookcase will be a pleasing feature in a room, but since mahogany is invariably stained down to the colour of the eighteenth-century examples, the effect of contrast would not be so sharp.

The carving at the ends of the backboard is done upon an applied fret. The ornaments of the backboard can be formed by mitreing up four pieces of shallow moulding to form a diamond. For this mahogany is a suitable wood, as it takes a black spirit stain well, and when filled and worked up is a good imitation of ebony. The same remark would apply to the beadings. The effect can be obtained on the backboard by the inlaying of the design indicated, in ebony or black veneer.

Construction.—There is a distinct advantage in devoting the lower space to drawers. They have their manifest uses and are always acceptable, and to grovel on the floor while searching for a book in the lower compartment is inconvenient, and glass doors that reach to within a few inches of the floor run obvious risks.

The carcass is made in one piece. The plinth is screwed on afterwards, and the backboard, which simply rests in position with dry dowels, is detachable.

The Ends and Back Frame.—A commencement should be made with the two ends A. These are jointed preferably with groove and tongue and converted to 43¼ in. in length by 13¼ in. in width. The bottom will

be dovetailed, and the middle shelf housed, framing flush at the front and $\frac{3}{4}$ in. at the back to allow of the framed panel back being screwed into a rebate that is worked on the inside edges of the two ends A (see Fig. B). The two top rails are dovetailed on to the ends, and both frame in to allow in the front for the thickness of the doors, and at the back for the back panel. Between these top rails fillets are screwed on to the ends and screws pass through rails and fillets securing the top.

In the back frame the two stiles run full length, a centre mullion between top and bottom rails, and the four cross-rails L are framed between these, the lower one so that the middle board C meets it centrally. This back frame is tenoned together and grooved for plywood panels oak faced, or matching whatever wood is used for the bookcase. The shelves rest on the movable supports G, which engage the serrated strips Q, screwed to the ends. While the movable shelves should be nearly the full width of the available space inside, the ends are notched so that

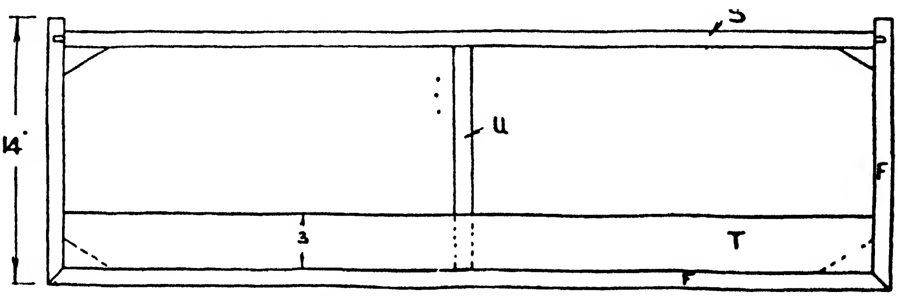


Fig. C.—Plan View of Plinth.

they can be raised freely within the serrated strips. A reference to Fig. B should make clear these details of construction. The back frame should be flush at the top and bottom of the carcass, and is screwed to the ends in the rebate, and to the top rail, and the two lower boards C.

Doors and Drawers.—The doors call for careful attention. In detail A is shown the section of the bar with the rebates worked on the front edges, allowing for the black beads to be mitred in from the front. These beads are not more than $\frac{3}{16}$ in. in thickness, so the glass must be cut with precision. The doors are tenoned and mortised together. All the bars mortise into the frame, but can be halved where they cross. They should be in perfect alignment, as any deviation is painfully noticeable. The front top rail forms a stop for the doors at the top, but at the bottom a small slip is fixed in the centre. Two flush bolts and a lock will secure the doors, or two pairs of ball catches are an alternative arrangement with which, if adopted, two handles will be needed.

To mask the joint of the doors in the centre a strip, T-shaped in section, and shown in front as a flat bead, $\frac{1}{2}$ in. wide, and stained black, is rebated and glued into the right-hand door.

The drawers are dovetailed together, and, when fitted and the fronts flushed with the front, the beads are rebated in, glued, sprigged, and

mitred round. They stand about ⅛ in. beyond the surface of the drawers. The backboard D is 6 in. wide, and has a ⅞ in. thick capping on that top projects in front, and at the ends about ¾ in. The moulding is a bead and fillet, or astragal.

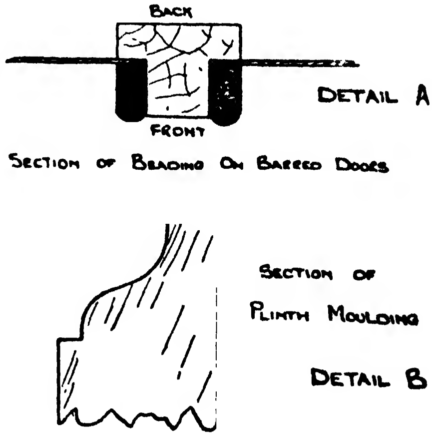


Fig. D.—Constructional Details.

The Plinth and Fittings.—Fig. C gives the dimensioned plan of the plinth. The back rail, framed on edge, about 1 in. in from the back, is dowelled and glue-blocked. The front is mitred and blocked. The cross-rail, dowelled, and a front batten T, are framed in and well blocked. The section of the moulding is shown in detail B (Fig. D), the extent to which the plinth sets under the carcass. Screws passing through the front batten and the back rail secure it to the carcass. The handles illustrated are black hard-wood knobs, but old brass handles of the drop variety would be quite suitable. These can be obtained in oxidised silver with oblong plates, and are distinguished in appearance. Though the size given is 4 ft. 8 in. in height by 3 ft. 9 in. in width, this can be modified somewhat, having regard always to correct proportion. A list of materials required is given.

CUTTING LIST

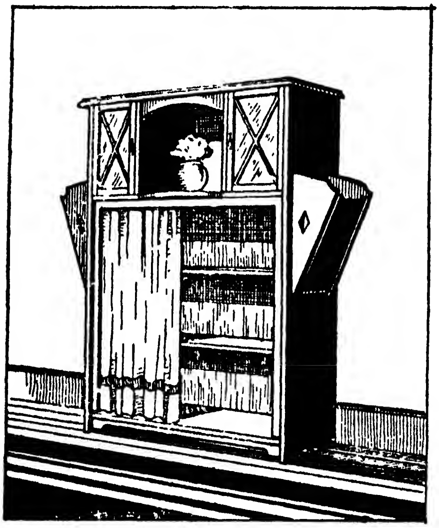
	Length		Width	Thickness.
	ft	in	in.	
A. 2 Ends	3	10¾	13¼	⅞ in.
B. 1 Top	3	9	14¾	1¼ ,,
C. 1 Bottom and 1 Middle Board	3	7	12½	⅞ ,,
D. 1 Backboard	3	7	6¾	⅞ ,,
E. 1 Capping	3	7	1¼	¼ ,,
F. Plinth Materials	6	6	3½	⅞ ,,
G. 3 Shelves	3	6½	10½	¾ ,,
H. 4 Door Stiles	2	10½	2	⅞ ,,
I. 4 ,, Rails	1	9½	2¼	⅞ ,,
J. 2 ,, Long Bars	2	6	⅞	⅞ ,,
K. 4 ,, Short Bars	1	7	⅞	⅞ ,,
L. 4 Back Panel Rails, 2 to cross-cut	3	8	3	¾ ,,
M. 3 ,, ,, Stiles and Centre Rail	3	9	3	¾ ,,
N. 4 ,, Ply panels	1	4	19	4 mm.
2 ,, ,, ,,	1	2	19	4 ,,
2 ,, ,, ,,		6	19	4 ,,
O. 2 Drawer Fronts	1	9½	8½	⅞ in.
2 ,, Backs	1	9½	8	⅝ ,,
4 ,, Sides	1	0	8½	⅝ ,,
2 ,, Bottoms	1	9	13	4 mm.
P. 1 Partition		8½	4	⅞ in.
Q. 4 Ratchel Strips	2	10	1½	½ ,,
R. 6 Shelf Supports		10½	1½	½ ,,
S. 1 Back Rail for Plinth	3	7½	3½	⅞ ,,
T. 1 Front	3	10	3½	⅞ ,,
U 1 Batten	1	1	3½	⅞ ,,

Material for Beading, stained black, 19 strips 3 ft. long, by ½ in. by $\frac{3}{16}$. Material for Ornaments. Material for Glued-on Frets for Carving. 4 Drawer Handles. 1 Cupboard Lock. 2 Flush Bolts.

BOOKCASE WITH MAGAZINE RACKS

The fitment illustrated, which will be found both useful and ornamental, would look well built in oak or mahogany, stained and french polished, or might be made in one of the cheaper timbers such as cypress or Oregon pine, finished in stain and afterwards varnished.

The Ends and Top.—The ends are $\frac{3}{4}$ in. thick and 12 in. wide, shaped at the bottom, as shown, and checked on the edges for the three-ply back (Figs. A and B). The top ($1\frac{1}{4}$ in.) is moulded on front and sides, and rebated on the under side to take the ends, which are tongued into it (Fig. E). Raggles are also cut into the ends to take the four shelves ($\frac{3}{4}$ in.).



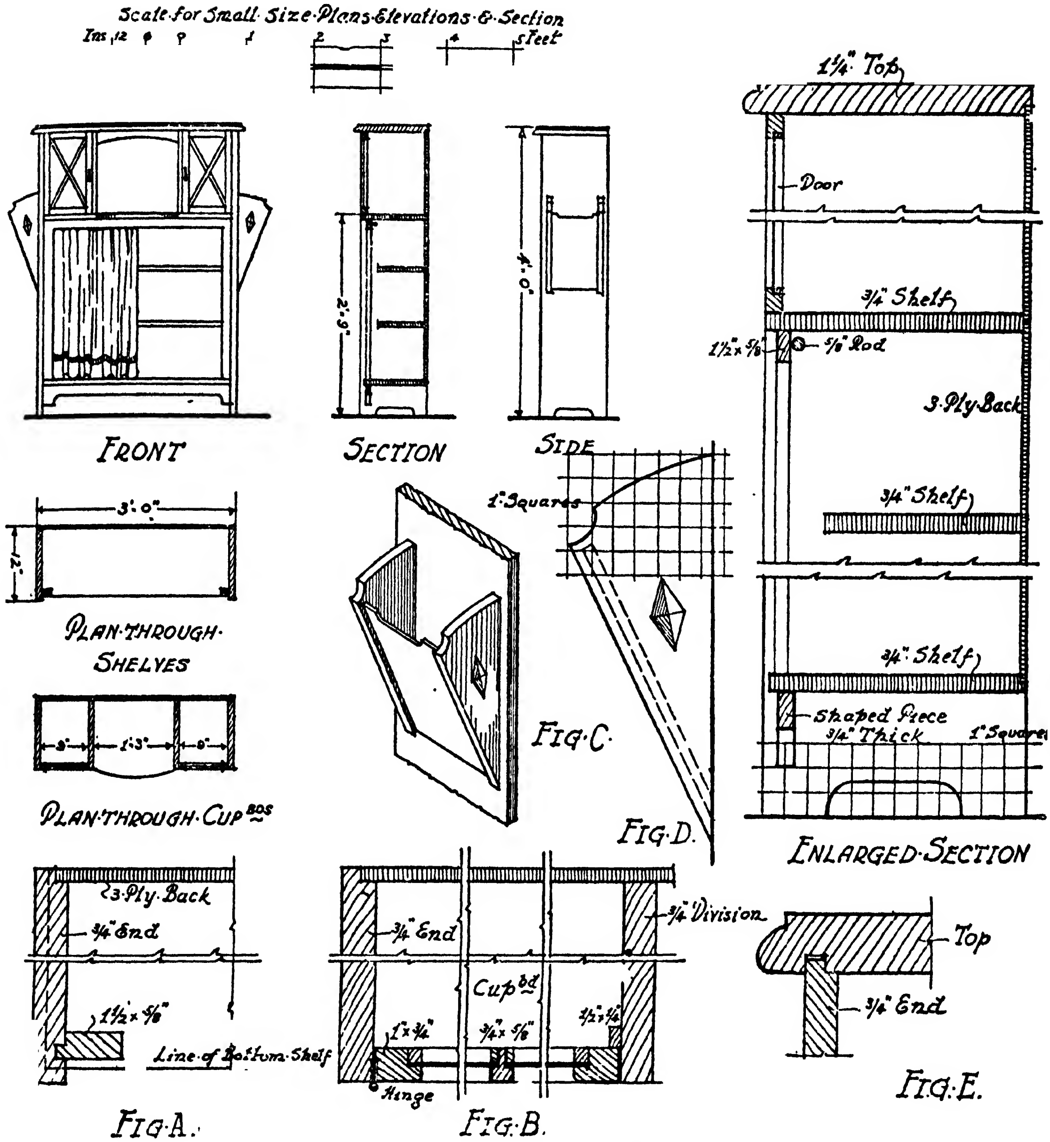
Completed Bookcase with Magazine Racks.

Shelves and Cupboards.—The lower shelf is fixed at 5 in. from the floor, and has a shaped piece ($\frac{3}{4}$ in.) nailed under it, whilst the two intermediate shelves are placed at suitable heights as desired. The top shelf, forming the bottom of the cupboards and the recess, is partly circled in front to add to the appearance of the fitment. Slips, $1\frac{1}{2}$ in. by $\frac{5}{8}$ in., to keep the curtain in position, are raggled into the ends and nailed to the under side of the top shelf (see Fig. A, enlarged plan taken through the shelves of the bookcase part). The curtain is hung on a $\frac{5}{8}$ in. diameter brass or steel bronzed rod, which is let about $\frac{1}{2}$ in. into the ends.

The top portion is divided into three divisions, two small cupboards and a recess. The intermediate divisions ($\frac{3}{4}$ in.) are raggled into the top and upper shelf, whilst the shaped piece at the front of the recess is out of $2\frac{1}{2}$ in. by $\frac{5}{8}$ in. stuff.

The stiles and rails of the small doors are 1 in. wide by $\frac{3}{4}$ in. thick, with $\frac{5}{8}$ in. by $\frac{3}{4}$ in. thick astragals, checked for the glass, which is held in position by wood fillets. A small $\frac{1}{2}$ in. broad by $\frac{1}{4}$ in. thick door stop is sprigged to the side of the intermediate divisions (see Fig. B, enlarged plan taken through the cupboards). A pair of small hinges and a drop cupboard turn are fitted to each door.

The Magazine Racks.—The magazine racks are 16 in. long, $6\frac{1}{2}$ in. deep, and 10 in. broad overall. The sides ($\frac{5}{8}$ in.) are shaped as in Fig. D, whilst the front could be $\frac{3}{8}$ in. thick, or of three-ply raggled into the sides. A diamond shape could be planted on to the latter (see Fig. C, completed view of one of the racks). The racks are fixed in position by



Constructional Details of Bookcase with Magazine Racks.

screwing the sides of same to the ends of the bookcase from the inner sides of the latter.

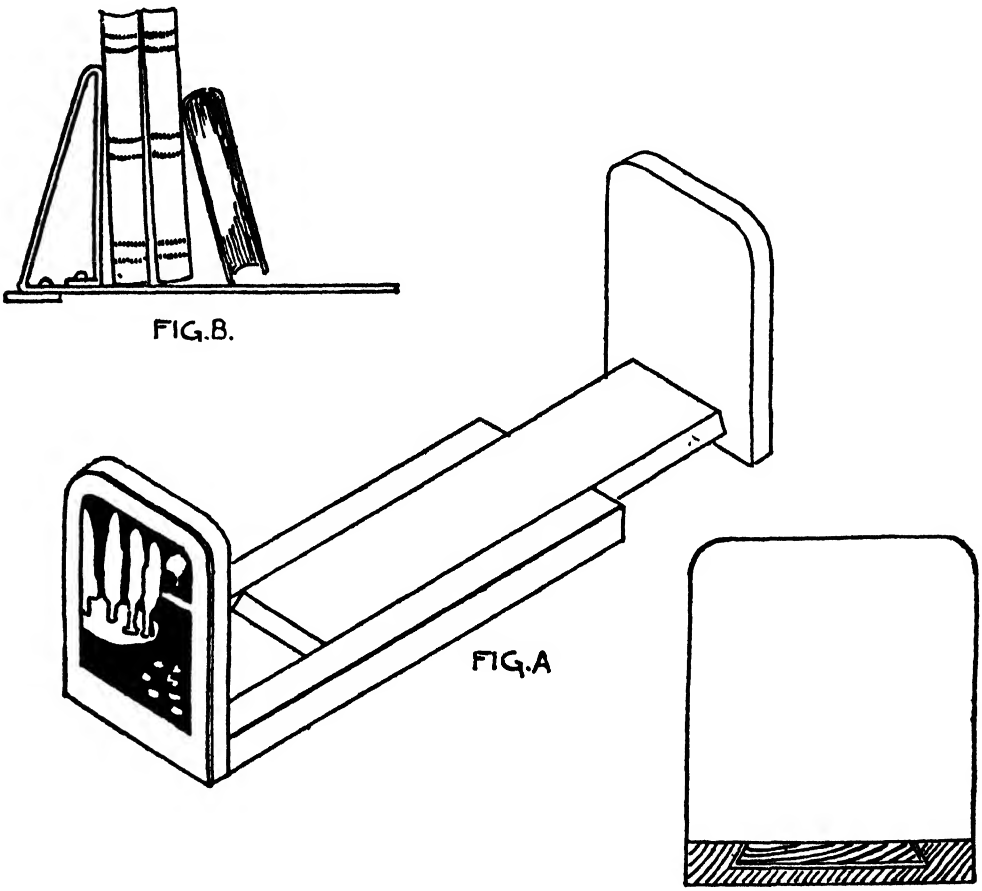
BOOK RACKS WITH BRASS ENDS

A book rack is always a very serviceable fitting for the writing-table, and since these book holders can be made up to hold a varying number of books by arranging the bottom part to slide, the ends can always be depended upon to support the books in position.

Fig. A shows a design where the bottom is made in two parts, and Fig. C shows how each piece is shaped to fit the one into the other. Where the book ends are formed in wood the bottom parts are dovetailed into the ends.

In designs where the book rack is made up in metal a good plan is to make the rack in two portions, one end of which is shown in Fig. B.

The etched book-end designs which are shown in Figs. A, D, E, F, and G can be prepared in brass or copper and screwed on to the wood end,



Designs for Brass Book Ends.

Fig. A, or the etching may be done on the solid metal end, as shown in Fig. B.

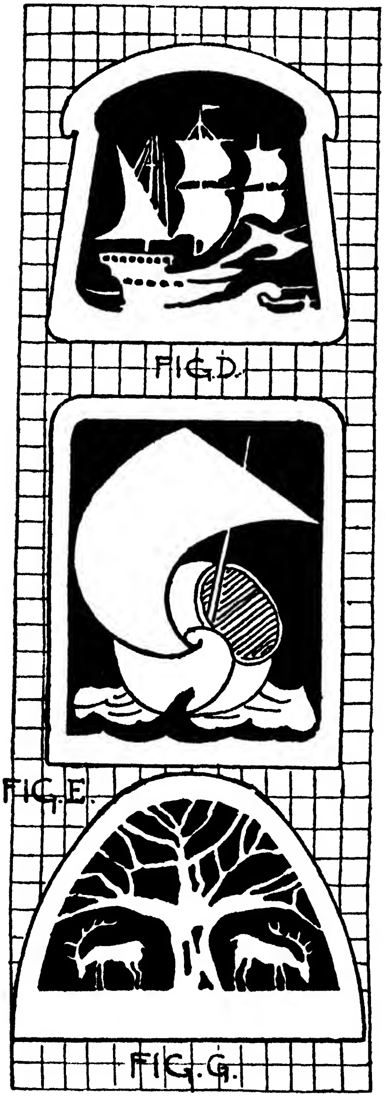
Twenty-gauge sheet metal is perhaps the most desirable for constructing the articles shown in Fig. B.

Construction.—The actual construction of the brass part of the book end involves no serious manipulative difficulties. The twenty-gauge

metal for Fig. A is cut with the tin-shears and filed to the line. The design is traced with carbon paper. It is desirable to use paper clips to hold the carbon and design in its place. The design is next coated with asphalt varnish, leaving the parts to be etched bare. Generally it is best to etch the sky and leave the ship or other principal parts of the design high. Other small areas will be etched to bring out the forms. Often fine lines can be etched to carry the form through an unetched area. The shaded parts in the designs indicate the etching. The back of the metal must also be painted.

FIG. F.

Design for Brass Book End.



Designs for Brass Book Ends.

The brasswork is now immersed in a solution of nitric acid, one-third acid to two-thirds water. If the solution is throwing off strong, yellow fumes or bubbling too violently, it is eating too fast and water should be added. Too rapid etching will permit the acid to get under the asphaltum block and spoil the lines of the design.

When etched to the proper depth remove from the acid and rinse in clean water. Clean off the varnish with turpentine. Polish the surface with fine steel wool.

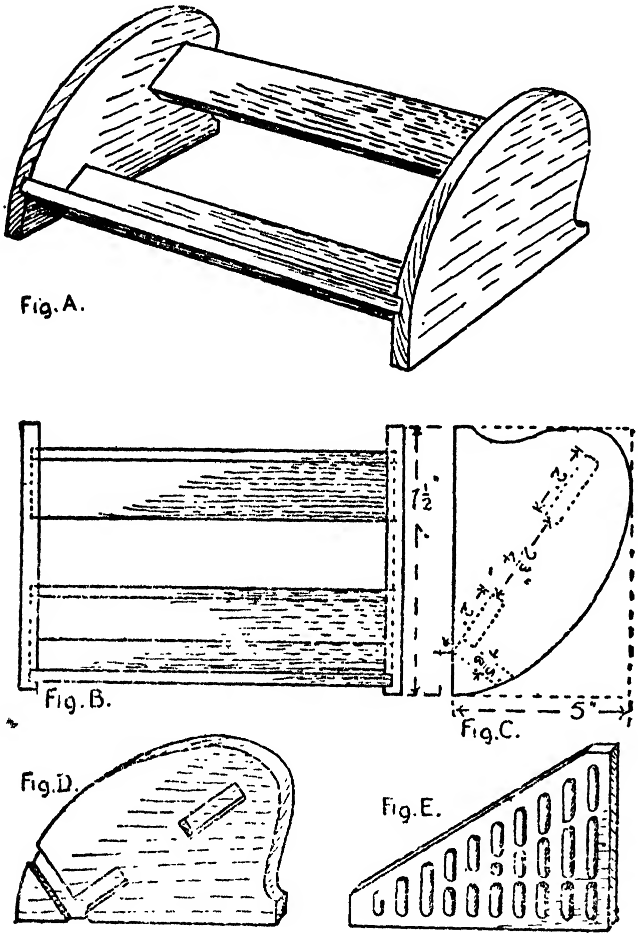
Sometimes these panels for book ends may be bulged outwards by pounding on the back with a round-headed mallet. The border outside the design may be peined with the pein hammer or left plain. A fine edging with the hammer, leaving the rest blank, sometimes gives an interesting finished appearance.

The ends may be finished in verde-green finishes. Mix one part perchloride of iron to two parts water; immerse the brass and allow to dry. The lacquers are difficult to handle, but good results may be obtained by rubbing on a finish with two or three coats of polishing wax.

BOOK TROUGH FOR THE TABLE

Although suitable for construction in any suitable wood, this design has been prepared for use with oak some six hundred years old. As oak of this age is apt to be exceedingly hard and correspondingly difficult to work, the constructional work should be limited to few joints.

The dimensions given for the end pieces are suitable for a table, the length being any convenient size. The finished piece of work, as in Fig. A, depends for its attractiveness on the simple curves of the ends. The three lengths forming the back and bottom of the trough are let into shallow slots or grooves cut into the end pieces, as shown in the plan and end view in Figs. B and C, and also in the separate detail in Fig. D.



A Handy Book Trough for the Table.

An alternative design for the end pieces, Fig. E, using straight instead of curved lines, utilises gouge cuts as a suitable decoration. The curved ends can be cut to shape with a bow saw and finished with a spokeshave, but it is advisable to mark out the position of the grooves and to cut them out before the shaping is done.

BOOT RACK

A boot rack is a useful fitting to have in the house, as, by its adoption, boots and shoes can be kept neatly stored instead of lying about in odd corners or taking up valuable cupboard space.

The type described and illustrated is simple in construction and economical in cost, and although sizes are given, these need not be strictly

adhered to, but can be modified so that the fitting may suit the needs of the household for which it is intended.

Construction.—The two ends, or haffits, are 10 in. wide by $\frac{3}{4}$ in. thick, and moulded at the top and bottom to the shape shown in Fig. B.

At intervals on the back edge of these end pieces, checks are formed to take the $4\frac{1}{2}$ in. deep by $\frac{1}{2}$ in. thick upright pieces behind the sloping shelves, the former being simply screwed to the ends as shown in Fig. A. The ends are also raggled on their inner faces about ˆ in. by $\frac{3}{4}$ in. to take the $\frac{3}{4}$ in. thick shelves, which are then glued into position and checked into the back upright pieces. The shelves project about $\frac{3}{4}$ in. beyond the front of the ends and are rounded on edge as shown in Fig. B. At approximately $3\frac{1}{2}$ in. from the upright pieces at the back of the shelves, straps $\frac{7}{8}$ in. broad by $\frac{5}{8}$ in. thick and slightly rounded on the top edges are screwed to the top face of the sloping shelves.

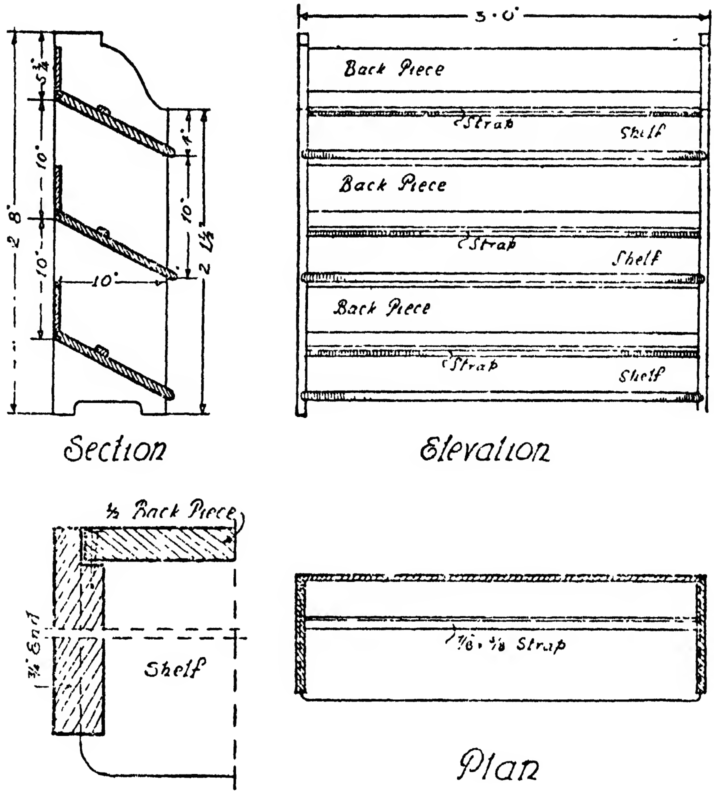


Fig. A.—Constructional Details of Boot Rack.

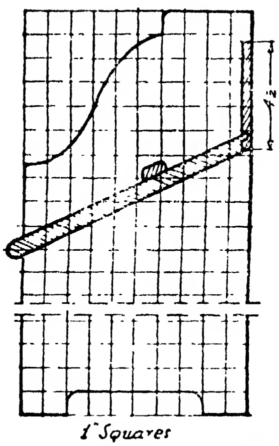


Fig. B.—Shape of Sides.

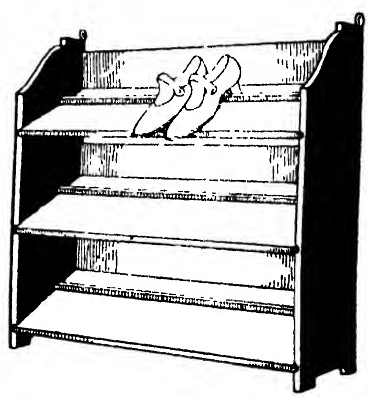


Fig. C.—The Finished Boot Rack.

The fitment can be made of white pine and given one coat stain and two coats varnish or painted three coats oil paint as desired.

Fixing the Rack.—An ideal place for fixing the rack is behind a cupboard door, and this can be done by means of mirror plates fixed to the top and bottom of the ends, while of course it can be erected in any other convenient position by the same method.

BOX MAKING

The art of making wooden boxes accurately and with sufficient strength to withstand ordinary rough usage is a limited one. For this reason the amateur woodworker who wishes to avoid dovetailing and ordinary lapping joints will welcome the appearance of a special form of moulding which, as our illustration, Fig. A, shows, greatly simplifies the making of boxes. The moulding in question has two slots of the same width and depth, and so arranged that the pieces of wood forming the sides are at right-angles to one another. The box can be made by gluing plywood into the grooves, the bottom being nailed on, as shown in Fig. B.

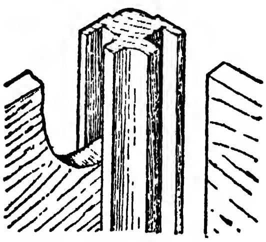


Fig. A.—Moulding for Box making.

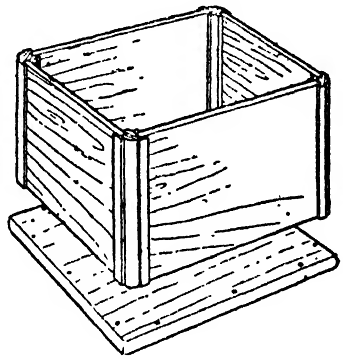


Fig. B.—Showing Method of making Box.

BOX OTTOMAN

This useful pieces of furniture has the great advantage of being easy to make. Deal is used throughout, and most of the joints are simply glued

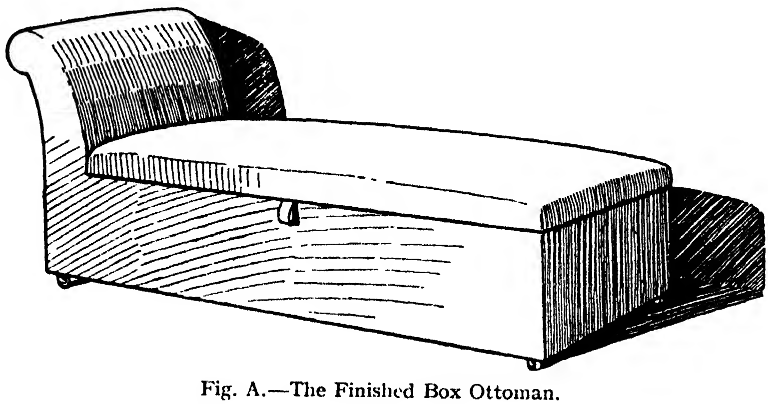


Fig. A.—The Finished Box Ottoman.

and nailed together. The seat, which acts as a lid for the box, is fitted with springs; also the head, Fig. B, gives the main sizes, which can be

followed if a piece of the usual size is required; they can be altered, however, to suit any particular requirements. Note that a space of 2 in. is

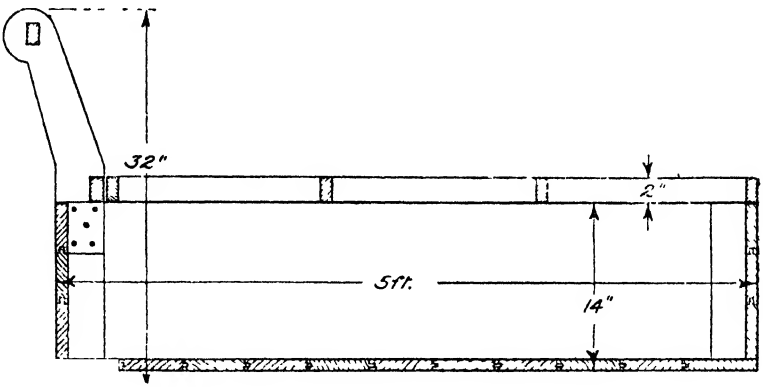


Fig. B.—Constructional Details of Box Ottoman

allowed beneath for the castors. As these vary considerably, it is advisable to buy them beforehand so that the exact size can be measured.

The Box Portion.—The main box part is made from 1 in. deal matchboarding, as shown in Fig. C. This should be purchased in suitable widths so that the correct over-all width is obtained. Cut all the pieces off to length and prepare the corner uprights shown in Fig. C. These are 3 in. by $1\frac{1}{2}$ in. deal. Those at the foot are quite plain, but the corner upright must be cut away as in Fig. D, so that the head uprights can be fixed. The whole should be firmly nailed together, turned upside-down, and the bottom fixed. This again is of 1 in. matching nailed across the box, not lengthwise. All sharp edges and corners must be removed to avoid tearing the covering material.

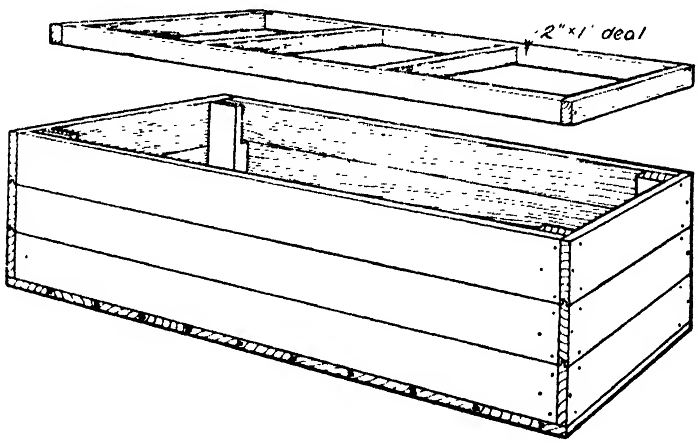


Fig. C.—Method of making the Box Part of Ottoman.

Head Frame.—The head uprights are cut to shape from $1\frac{1}{2}$ in. deal. Cut away the bottom ends so that they fit in the slots in the corner uprights, outer faces level with the sides (Fig. D). Slots are cut as shown to take the lower rail, and mortises for the top rail. To assemble the whole, glue the top rail into its mortises, screw the lower rail, and glue the whole

into the slots in the corner uprights, adding screws afterwards. The sharp edges of these parts must be removed as in the box part.

The Lid.—The lid consists of a simple frame nailed together as in Fig. C. In this illustration the corners are simply butted, glued, and nailed.

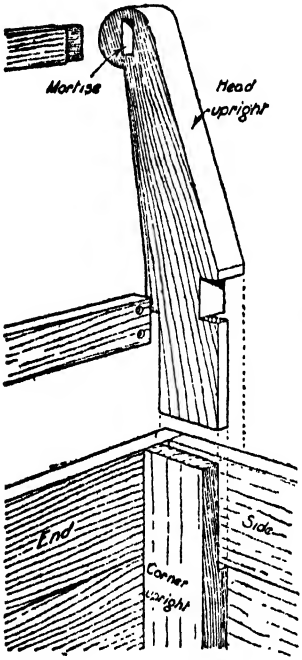


Fig. D.—The Head Frame.

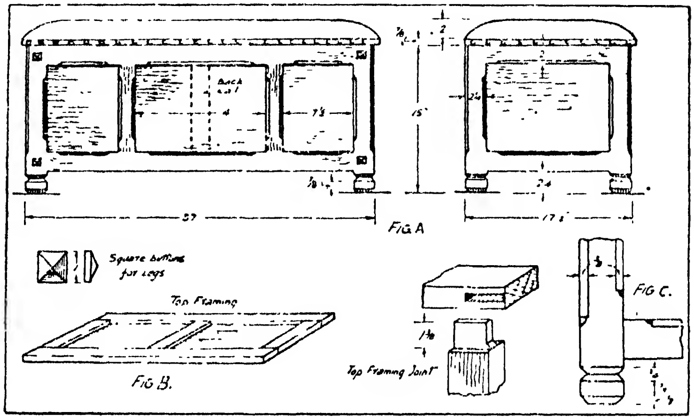


Fig. F.—Box Ottoman and Constructional Details.

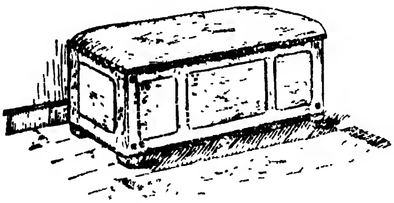


Fig. E.—Another Type of Box Ottoman.

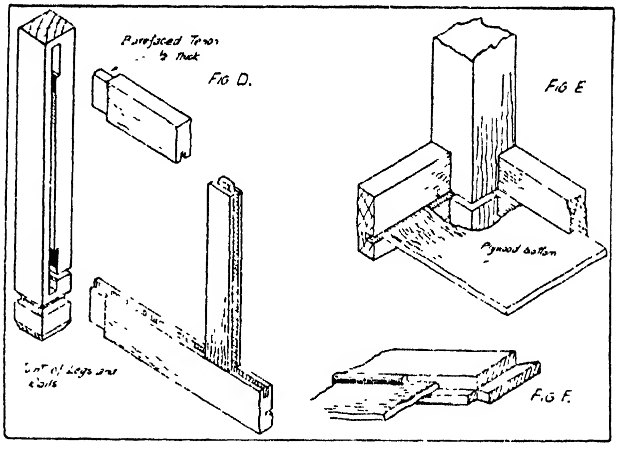


Fig. G.—Some Joint Details of Box Ottoman.

A rather stronger job can be made by halving the corners. When the edges have been rounded over the whole is ready for upholstering.

The Upholstery.—The webbing is fixed to the under side of the lid framework and the strands interlace in the usual way. The springs are placed on top, stitched in position, and tied together at the top with twine to keep them upright. The canvas is then added and the stuffing placed on top and tied. Another piece of canvas is placed over this, next a layer of wadding, and lastly the final covering. It is advisable to tack a piece of material to the under side to hide the webbing.

At the head, the webbing is fixed at the back of the rails. The springing is similar to that of the lid. Note that the upholstery must be thin at the bottom to allow sufficient clearance for the lid. The covering of the box part is simply stretched and tacked, but it is advisable to first tack a piece of canvas over the whole. The finish of the inside is immaterial. A lining of cheap material or even paper is suitable. The lid is hinged at the back and a tab is fastened at the front to facilitate opening.

Another design of box ottoman of the "headless" type is shown in Figs. E, F and G. The constructional details and the dimensions given in these diagrams will enable anyone to make this attractive model of a box ottoman.

BOXES AND CRATES, MAKING

The proper way to fit the parts of a nailed box is shown in Fig. A. There are other ways, some examples of which are seen in Fig. B. There are reasons why these latter are inferior ways, and when we see a box in which many of these faults occur we know it must have been made by someone whose knowledge of woodworking was almost negligible.

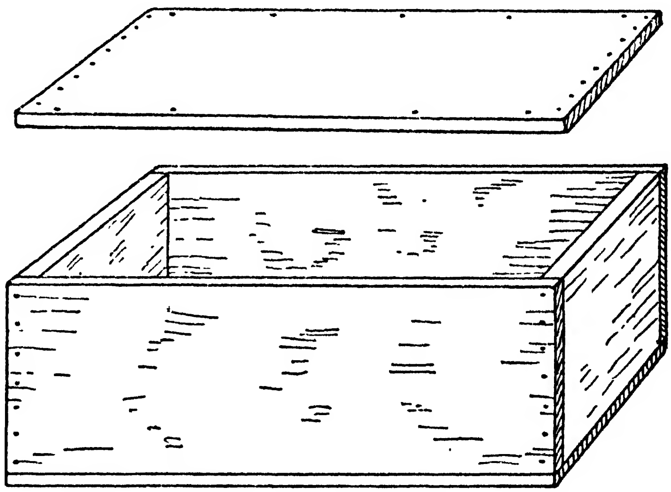


Fig. A.—Simple Box with Thick Ends and no Cleats.

The professional way of making a box is to let the sides run the full outside length and fit the ends between. The bottom is put on after the sides and ends have been nailed together at the corners, and both bottom and cover measure the full outside length and width, as seen in Fig. A. Until the bottom is nailed on, the sides and ends are weak at the corner joints, and liable to be out of square. The box should be tested for squareness before nailing on the bottom, as it cannot be corrected after. If the bottom is cut square to the right size, it is sufficient to see that the edges are flush all round when it is being nailed on.

If the box measures the same each way, then we simply prepare two pieces to correspond with the outside measurement and two corresponding with the inside and nail them together. But if the box is longer one way, then the pieces running that way should be the outside length and overlap the ends of the shorter pieces. This applies to boxes which are nailed together. In some other methods of construction, dovetailing for instance, all pieces correspond in length with outside measurements.

In a box which is nailed together the end pieces should usually be about twice the thickness of the wood used for the sides, bottom, and top. The reason is that a great many nails have to be driven into the edges of the

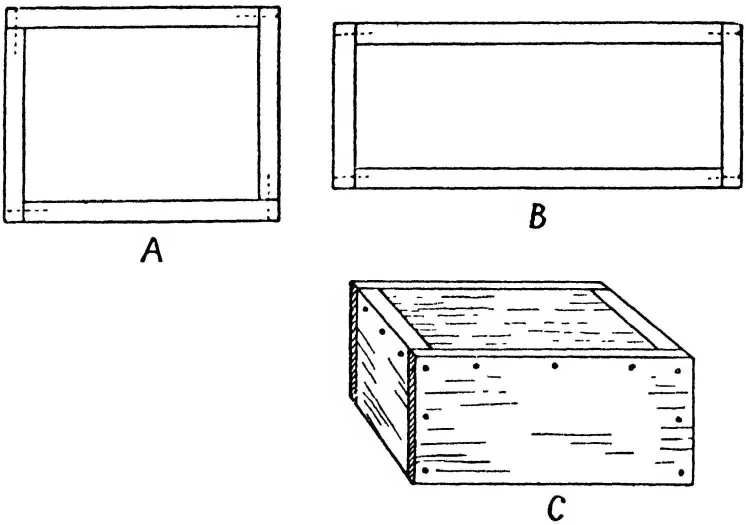


Fig. B.—Some Errors in Construction which are the " Hall Mark " of Uninstructed Beginners.

A. Sides of a Box lapping at one End and butting at the other.
B. Long Sides fitted between Short Ends.
C. Bottom fitted Inside instead of nailed on Top.

end pieces, and if they were not extra thick there would not only be risk of splitting them, but the points of badly driven nails might come through at one side. This extra thickness is the reason why the end pieces run the shortest way of the box, because it is economical of material. The difference often does not amount to much on a single box, but the principle is adopted in all boxes. Nails need to be closer across the grain at ends than along the sides.

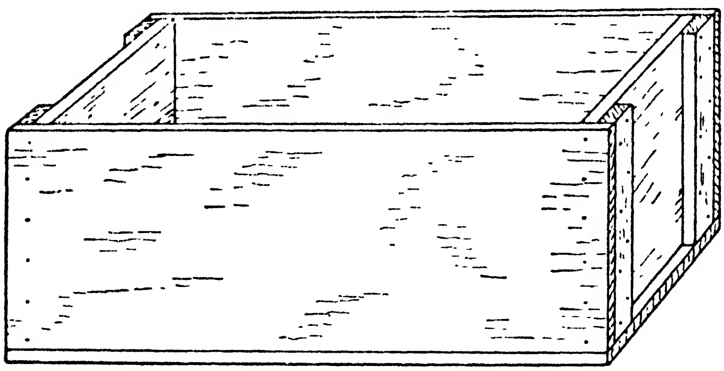


Fig. C.—Ordinary Cleated Case of Moderate Size.

The bottom is nailed on instead of between because it is a stronger way. Nailed between, as at C in Fig. B, a blow on the bottom might cause it to split away from the nails which are driven into its thin edges, or much the

same effect would be produced if the lower edges of the box split away along the line of nails.

Packing-cases.—These are generally too big to be made in the simple way shown in Fig. A. Greater strength is obtained and material economised by nailing cleats across the grain of the end pieces instead of making them of thicker wood than the other parts. A common example is shown in Fig. C. These cleats stiffen the ends and prevent warping or splitting. It simplifies construction also when the width of wood is too great for single-piece ends, the cleats serving the further purpose of holding two or more pieces edge to edge in preparing the end pieces. Cleats may be inside or outside the box, but outside is generally best.

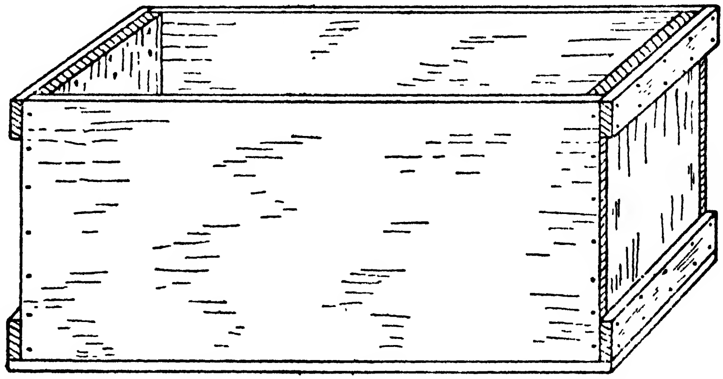


Fig. D.—Grain of Ends Vertical as the Case has Greater Depth than Width.

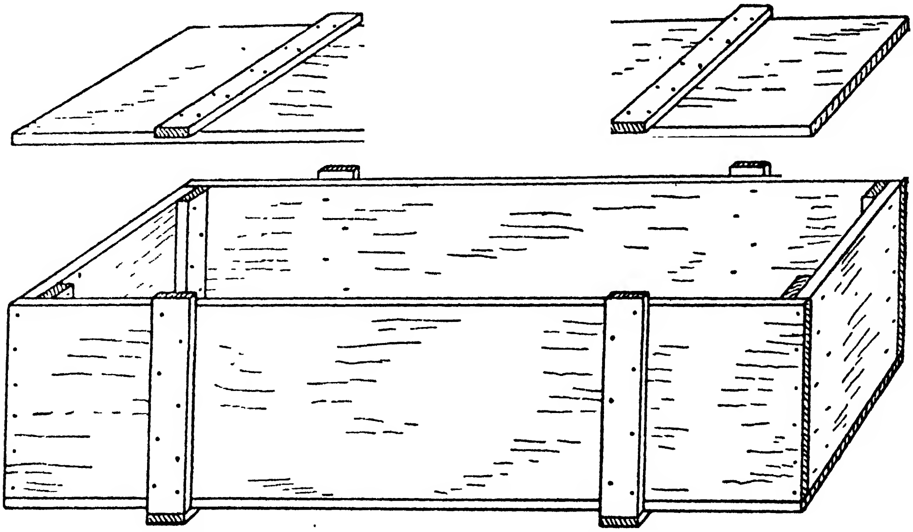


Fig. E.—Large Case Cleated at Intermediate Positions.

Another method of construction is shown in Fig. D, where the grain of the end pieces runs vertically instead of horizontally like the sides. This is done as a rule when the depth of the box is greater than the width, for it is a regular practice in all woodwork to have the grain running the longest

way of the pieces. The arrangement in Fig. D is not so often seen as that in Fig. C, because deep narrow cases are less used, it generally being more convenient to have the wide way of the box open for packing and unpacking.

Very large cases, especially when their length is great, are often strengthened by intermediate cleats, as in Fig. E. These stiffen the wide surfaces, and are often an advantage in making up the widths before the case is nailed together. Also they raise the under surface slightly off the ground, protecting it from damp, and leaving space for inserting fingers or a lever for lifting.

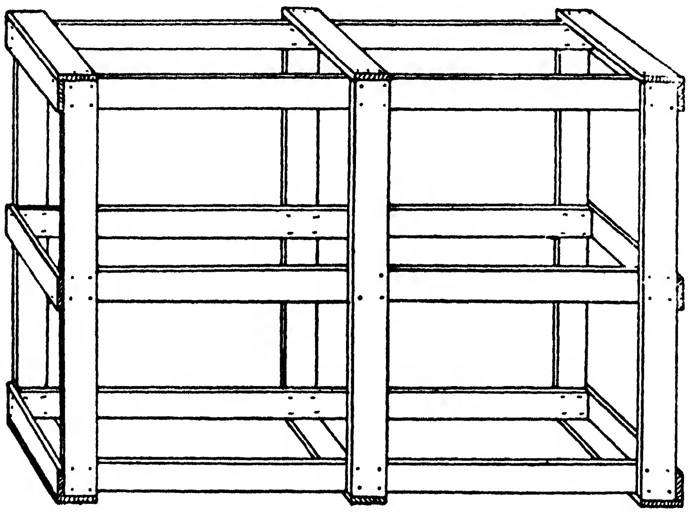


Fig. F.—A Typical Wooden Crate.

Crates.—These are used when it is not necessary to have a completely closed-in box. It saves wood and reduces weight, besides which people who have to handle the crate with its contents can see how much care is necessary and which side should be uppermost. An example of a crate is shown in Fig. F. In this instance the sides, that is the portions of largest area, are made first by cutting the horizontal and vertical pieces to length and nailing them together, the nails being clinched. Then these two frames are connected at the proper distance apart by nailing on the short cross-bars at corners and midway positions, long nails going into the end grain being used.

The design of crates varies according to the shape of the article to be crated. Diagonal braces are often used and internal bars and blocks. When a crate is so wide that intermediate longitudinal rails are needed in ends, top, and bottom, then all these parts would first be made separately like the sides, and nailed together after. Thickness and width of wood and the number of pieces used determine the strength. Plain lapping joints are used everywhere, as in packing-cases.

BUNK BEDS

A double-tier bed, similar to a ship's bunk, will be found very useful for a small room in which it would be inconvenient to put an ordinary double bed.

There are numerous ways in which the framework might be made dependent on the type of spring mattress it is proposed to use.

One of the commonest of the latter is the woven wire mattress in a wood frame with provision for end-long tightening when the wire becomes slack. With two of these it would be possible to fix up the beds with corner posts only, notched into and screwed to the wood frames, but it would have to be done in a way that prevented unsteadiness and rickety joints when the structure was complete. Fig. A shows a rigid stand on which any kind of spring mattress could be placed on top and bottom. An inferior alternative to a spring mattress is to use webbing or canvas stretched over the wood frame. The structure shown is screwed together, the sides being made first and the end cross-pieces being screwed on in

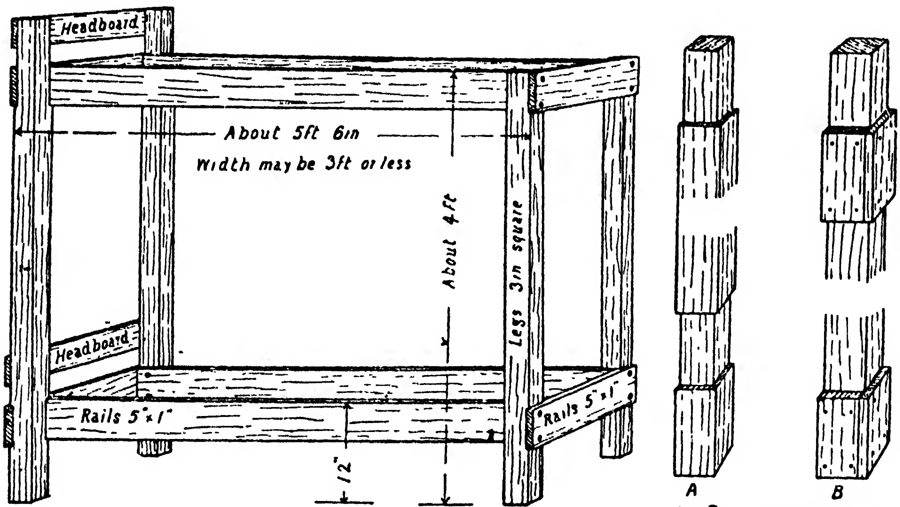


Fig. A. Framework for double tier bed

Fig. B Alternative ways of shouldering the posts

Showing Framing of Bunk Bed.

the room where it is erected for use. The upright posts are rebated, say, ¼ in., to provide the horizontal rails with ledges to rest on so that downward pressure will not come entirely on the screws. In Fig. B a post is shown rebated at A, and one at B has pieces nailed on instead, which is less trouble, but it is not so neat a way as cutting rebates. The longitudinal rails are attached to the inner faces of the legs so that the frame of a mattress may bear its entire length on them, but if this is not convenient it would be sufficient for it to bear on the end rails only.

CARD TABLE

Plywood in its modern form offers much scope to the designer and craftsman, but the numerous advantages can only be fully realised when the constructional methods are logically adapted to the nature of the material.

Plywood is supplied in sheets of handy sizes and thicknesses, and is, therefore, most conveniently utilised in that form, hence the trend of

design must eventually tend to the elimination of framing and the substitution of a technique based on the employment of relatively large flat sheets.

The card table illustrated in Fig. A is a case in point; it may appear to be heavy, but in reality is very light in weight, probably lighter than the old-fashioned pattern. It consists of five pieces of plywood, one for the top, two for the legs, and two stiffeners, the whole very easily shaped and fitted together without elaborate joints. Moreover, it can be made very easily, either under manufacturing conditions or by the home worker. Framing is entirely eliminated, and with it go all intricate joints and the labour involved in their making.

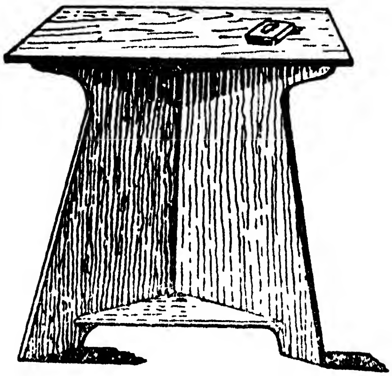


Fig. A.—The Finished Plywood Card Table.

Construction.—All that is required in the construction of this table is to cut one piece of plywood about $\frac{3}{16}$ in. thick to a square shape 24 in. long on each side. Two other pieces of similar plywood for the legs are then cut to the shapes shown in Fig. B, both pieces being alike except for the central slot, which on one piece reaches from the top to the centre, and on the other from the centre downwards to the lower edge. Note the shallow recesses at the top, which, like the slots, should be equal in width to the thickness of the plywood. Two more pieces are required for the stiffeners, each as shown in Fig. C. They are square in shape, 14 in. long on each face, and have diagonal slots equal in width to the thickness of the plywood at each corner, and extending to a distance of $1\frac{1}{2}$ in. All these pieces can either be sawn to shape with a fretsaw, or any fine-toothed handsaw, or can be cut with a sharp strong knife, guided with a steel straight-edge. After cutting, the edges have to be sand-papered perfectly smooth, and filled with any good-grade wood filler, of which small quantities for amateur use can be had for a few pence from most tool dealers and ironmongers. All the parts are then rubbed down with very fine sand-paper, stained to any selected colour, and varnished or polished as desired.

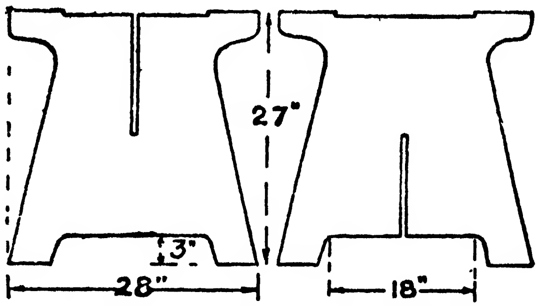


Fig. B.—Shapes and Dimensions of Members.

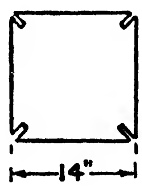


Fig. C.- The Stiffeners.

Assembling the Parts.—The table is assembled by sliding the slotted portions of the legs (Fig. B) one into the other after the application of glue to the joint faces. The edge of the upper recessed portion is then coated with adhesive and one of the small square pieces inserted, and secured with a few very fine panel pins about ¾ in. long. The other stiffener piece is then similarly fitted to the bottom part, and they will be found to bind the whole very firmly together. Leave the legs until the adhesive has set hard, then glue the top board to the legs and secure it with a few fine short screws or panel pins, noting that the legs extend diagonally from corner to corner. The result is a remarkably rigid and light card table which need not be baize or cloth covered unless specially desired. When this is requisite, it is desirable to glue a fillet of wood about 1 in. wide and ¼ in. thick around the under side of the top, and about ⅜ in. in from the outer edge, as seen in Fig., D to provide sufficient thickness for the upholstery tacks which are needed to fasten the cloth.

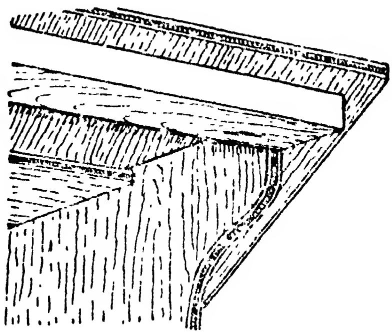


Fig. D.—For covering with Cloth a Fillet of Wood is glued to the Under Side.

CHESTERFIELD COUCH

The Chesterfield couch, shown at Fig. A, can be made with two drop ends if desired, but in the details of construction shown one end only is made with a drop so that the framing required for a fixed end can be constructed. The dimensions of the wood required are shown in Figs. B to E. Fig. B shows the front view, Fig. C the plan, Fig. D the elevation of the fixed end, and Fig. E the elevation of the drop end. It is usual to attach the various members of the framework with dowels, and if the work is carefully done, the joints are quite strong, but a combination of mortise and tenon and dovetail joints undoubtedly makes a stronger framework. Enlarged details of the framing are shown at Figs. F to H—these show clearly the construction of the two ends, and the rack for the adjustment of the drop end.

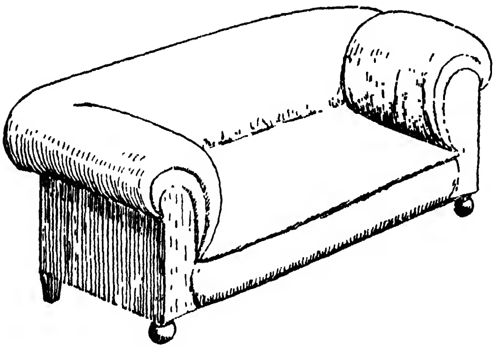


Fig. A.—The Finished Couch.

The wood commonly used for the framework is birch, but care should be taken to procure well-seasoned material. Beech, if readily obtainable, is excellent material, but soft woods, such as yellow deal, are not suitable. The wood should be smooth sawn to the sizes given; there is no need to

use planed wood except at the extremities of the two back legs, and this is quite easily done.

Constructing the Framework.—Begin the construction by cutting off the lengths for the two back legs and the connecting lengths from materials 2 in. by 2 in. The two legs, marked A, are 23 in. long, the front rail B is 5 ft. long, the back rail C is 4 ft. 8 in. long, and the two end rails D and E are 23 in. long. All these lengths are exact finished sizes, and include accurately sawn square ends; the greatest care must be taken here to cut the material square, otherwise there will be difficulty when the parts are fitted together.

Mark off lines 3 in. from the bottom of the legs A, and then 2 in. above, and mark off also lines 2 in. from the ends of the front rail B. These parts

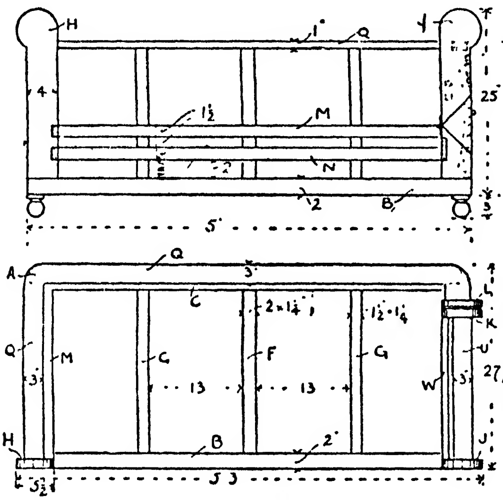


Fig. B (above).
Fig. C (below)

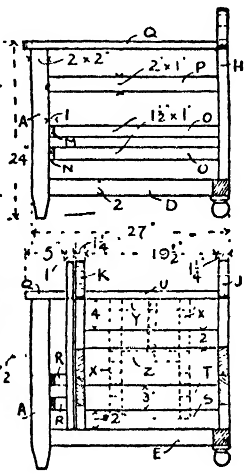


Fig. D (above).
Fig. E (below).

are now ready for dowelling. The method of dowel jointing is shown at Fig. J, and consists of fitting suitable lengths of prepared birch dowelling into holes bored into the wood. To be successful in dowelling, considerable care is required in marking out the holes and in providing a dowel to fit exactly the bored hole. In order to obtain accurate spacing, it is advisable, when there are many holes to be bored in the same position, to have a template with holes bored in the correct position; but if this is not done, great care must be taken to ensure that the centres of the holes are accurately marked. For the work in hand, dowels $\frac{5}{16}$ in. to $\frac{3}{8}$ in. in diameter can be used; the dowel should project far enough to fit in the opposite piece for about three-quarters of its thickness. The three connecting rails joining B and C are 23 in. by 2 in. by $1\frac{1}{4}$ in. at F, in the centre, and 23 in. by $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. at G, each side. The three shaped pieces at H, J, and K are cut from $1\frac{1}{4}$ in. wood, with a total length of 25 in. The main width is 4 in., and the curved top $5\frac{1}{2}$ in. diameter, but the extra

width can be given by gluing on a $1\frac{1}{2}$ in. wide strip, as shown by the dotted lines at Figs. F and H, the shape being sawn to the curve with a bow saw. A similar-shaped piece is required at L, but this is cut from wood

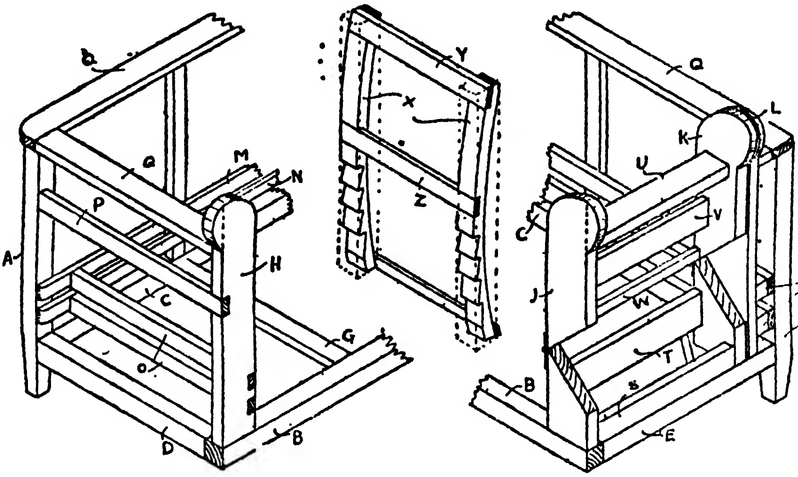


Fig. F. Fig. G. Fig. H.

Details of Framework for Chesterfield Couch.

1 in. thick. The two back legs A are joined by two 5 ft. lengths M and N, both $1\frac{1}{2}$ in. by 1 in., and screwed on, 2 in. up and $1\frac{1}{2}$ in. between. Dowelled to the pieces M and N, and housed into the inner edge of the front piece H, are two lengths, $1\frac{1}{2}$ in. by 1 in., marked O, and 4 in. from the top of the leg is a similarly sized and jointed piece P. The top rail Q is 3 in. wide and 1 in. thick, it is rounded at the back corners, dowelled together, screwed to the top of the legs, dowelled to the inside of the front piece H, and also to the back of the piece at L, this being supported at the bottom by a corner bracket, screwed to the rails, and attached 2 in. from the inside of the back leg, suitable blocks being fitted in as at R.

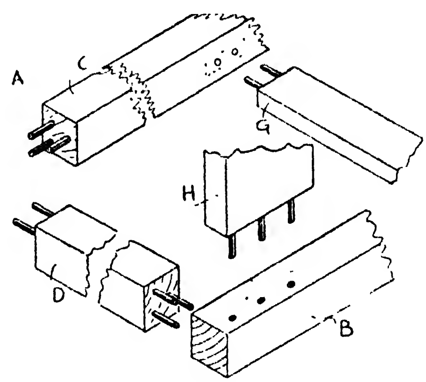


Fig. J.—Details of the Joints.

The drop end is made by sawing out a right-angle piece from the two pieces J and K, the apex of the angle being $6\frac{1}{2}$ in. up. The lower portions are dowelled in as at H and joined together with dowelled lengths, one at S being $19\frac{1}{2}$ in. by 2 in. by $1\frac{1}{4}$ in., and the other at T being $19\frac{1}{2}$ in. by 3 in. by 1 in. The upper portion is fitted together by dowelling one top piece,

3 in. by 1 in., as at U, another piece V, 3 in. by 1 in., and a third length W, 1½ in. by 1 in., all of them being 19½ in. long. The two portions of the pieces J and K are hinged together with stout back-flap hinges. Lengths corresponding with the connecting rails F and G are now fitted between the back rail C and the top rail Q. Turned feet, 3 in. long, are fixed to the ends of the front rail B, and then to complete the construction the adjusting rack at Fig. G should be made. In order to give the necessary curve, the two sides X should be cut out from two 20 in. lengths of 2 in. by 2 in. wood, the connecting rails Y and Z being 1½ in. by ½ in. or so. It will be as well to work out the two curved pieces and join them together as shown and then to place the frame in position as shown by the dotted lines at Figs. B and E, so that suitable distances can be set out for the notches. When these are cut, the rack is hinged to the under side of the top rail U, so that the bottom notch fits on the rail at S. A knob is fitted later to the centre of the rail Z, but from this rail to the front edge of the rail U a spiral spring is attached; this will keep the rack in position.

All the joints should be glued up with hot glue, care being taken that it is strong and thin, otherwise it will be difficult to get the joints to fit up close.

The Upholstery.—The webbing should be of best quality; at the bottom it is secured to the under side of the rails, four rows from end to end equally spaced and three rows between the connecting rails, all interlaced. At the back, there are two long rows and three between as at the bottom, the top ends being attached to the front of the top rail Q and the bottom ends attached to the back of the rail M. The vertical strips of webbing at the fixed end are attached to the inside of the rail Q and at the back of the top rail O, the same method being adopted at the drop end, the bottom rail being indicated at W. The horizontal lengths at the back and ends are tacked on to the inner surfaces of the uprights.

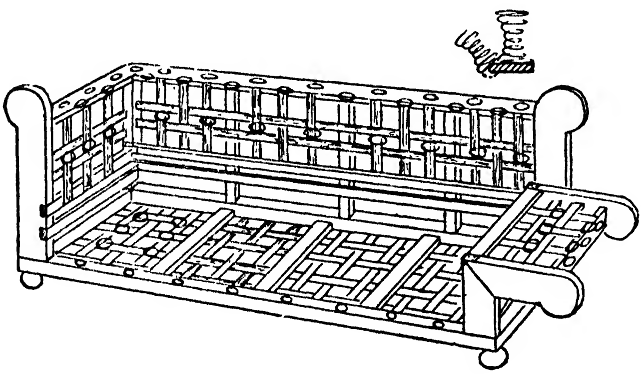


Fig K.—The Complete Framework.

The springs for the seat should be 10 by 9; there are three rows of eight each; these are spaced out equally and stitched to the webbing in the usual way. At the back there are eight 6 by 12 springs, and three at the ends the same size; these are spaced out equally and sewn on between the two long rows of webbing. For the top rail there are thirteen 7 by 9 springs, attached directly to the rail, and in between them, but tilted

inwards, are fitted twelve, including the ends, 7 by 9 springs with the top coil removed by filing and breaking off. One loop of the spring is attached to the top of the rail, but the other side is drawn down by a loop of webbing through the second coil and is tacked to the under surface of the rail so as to give the necessary tilt as shown in the separate detail in Fig. K. Eight 7 by 9 springs are attached to the front rail. All the springs are now lashed across at the top to keep them in position and a length of rattan cane lashed to the front coils, and then the whole of the springs, seat, back, and ends are covered with spring tarpaulin, the latter being drawn under the springs in front above the rattan-cane edge.

The canvas is now string looped all over and covered with fibre stuffing and then with scrim, but care must be taken to distribute the material evenly. A second stuffing is required, covered with calico, and before the final covering is attached two layers of wadding should be placed over the seat, back, and ends.

CHINA CABINET, MADE FROM WALL PRESS

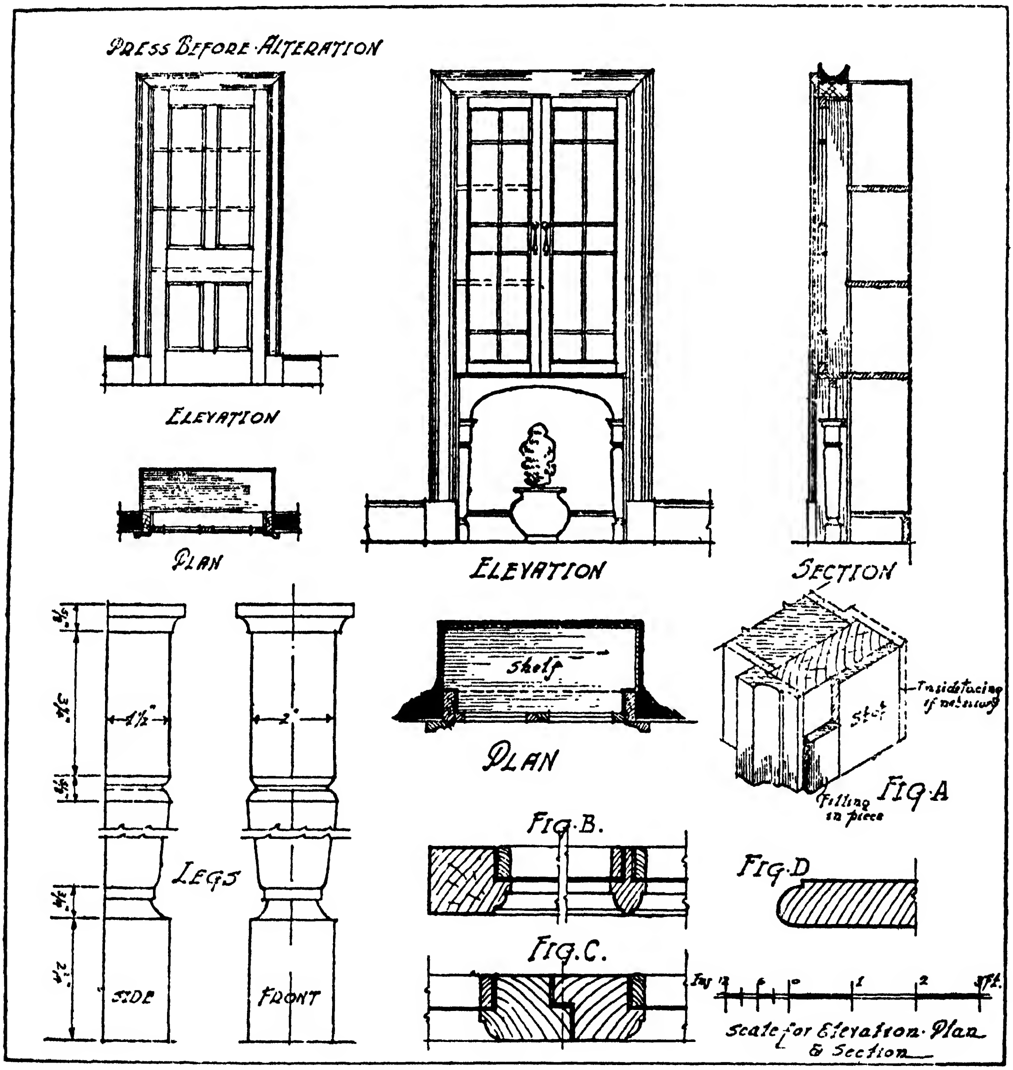
The accompanying drawings show how an ordinary wall press may be transformed, with very slight alteration, into an attractive display or china cupboard, and an elevation and plan of the press before alteration is provided, along with other drawings, showing the construction necessary to give effect to the alteration.

Removing the Door.—The first operation is to remove the existing door, which should be stored away for further use if and when required. When this is done, it will probably be found that the bottom shelf is not sufficiently wide to finish in line with the outside of the door frames, in which case it will be necessary to add to the width of the shelf, which should be finished on the edge with the moulding as shown in Fig. D. The additional width of shelf should be supported by being checked into the door stop at each side of the doorway. The upper shelves may also be made wider if desired, finishing, of course, behind the glass door, but this is not absolutely necessary.

After the door is removed it will also be seen that there is a gap the thickness of the door stop, left between the back edge of the latter and the front of the door post, and, from the point of view of appearance, it will be better that this should be filled in with a piece the same thickness as the door stop and of the same breadth as the thickness of the door removed. This filling-in piece is illustrated in Fig. A, as is also an inside facing, which, if not already in position, could be fixed to the back of the door post so as to hide the joint between the plaster and the door frame, and also makes a better finish to the inside of the press.

The Legs.—The two legs at the lower section of the cupboard are moulded as shown and are square on plan. These legs are screwed to the woodwork of the door frames as is also the shaped piece under the bottom shelf. This shaped piece is 1¼ in. thick, and instead of being screwed, might be raggled into the adjoining woodwork.

The Door.—The glass door is in two leaves, the framing being 2 in. broad moulded as shown in Figs. B and C, and checked for the glass which is held in position by means of beads $\frac{1}{4}$ in. broad. The thickness of the door framing should be similar to the old door taken down. The astragals



A China Cabinet made from a Wall Press.

are $\frac{7}{8}$ in. broad and the same thickness as the door framing, as shown in Fig. B. The centre stiles of the door are half checked, as shown in Fig. C, and the door should be fitted with drop handles, a cupboard lock, and hung on 3 in. brass hinges.

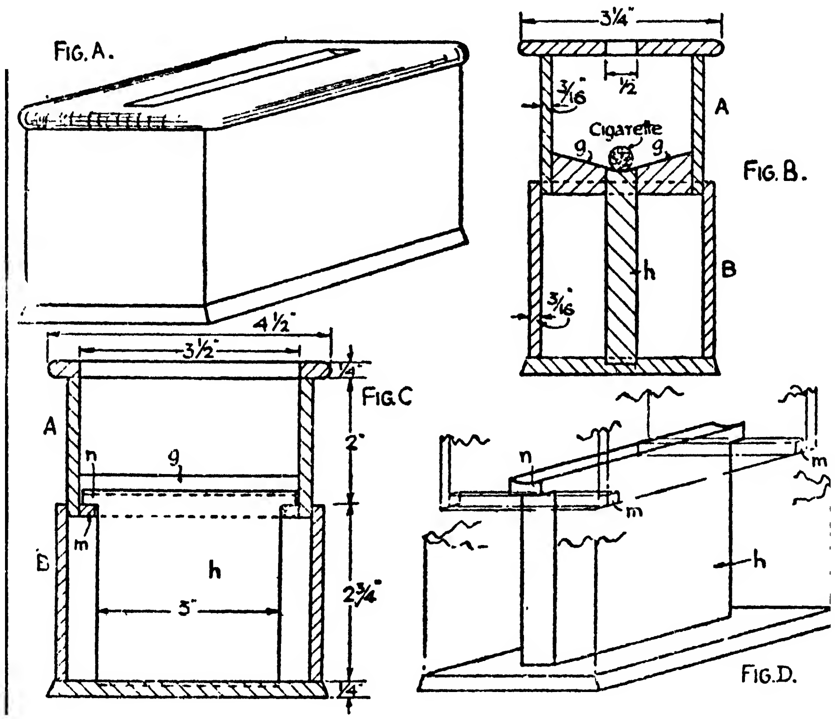
Suitable Woods.—The door, legs, and shaped piece could be made out of cypress and stained and varnished or painted to match the existing

woodwork, whilst the interior of the cupboard and shelves could be covered with canvas of an art shade or other suitable material. The back and side walls of the lower portion of the cupboard would look well papered with a wall-paper having a rich design.

CIGARETTE BOX

A particularly neat and novel cigarette box, for desk or table use, is illustrated below.

The box is made of two parts, namely, a base B (Fig. B) and a lid-liner A. If the latter is slid upwards, or raised, by means of the top cover, and



A Self-acting Cigarette Box.

then lowered, a cigarette from inside the lining A will be caught on the delivery groove at the top of member *h* (fixed to base of B, as shown in Fig. B), and when A is completely lowered the cigarette will, accordingly, appear through the slot in the top of the cover A. As the base of the lining A has sloping sides *g*, the cigarettes will fall, naturally, to the groove in *h*, until the supply is exhausted.

Fig. A shows the outside appearance of the cigarette box, the rounded slightly overhung cover with the slot for the delivery of the cigarette being clearly depicted. The complete box should measure about 4½ in.

long by $3\frac{1}{4}$ in. wide, by 3 in. deep; this ensures a convenient size and a capacity for about 20 to 30 cigarettes.

Fig. B illustrates the working of the sliding device; it is a cross-section through the centre of the complete box. It will be observed that the central delivery slot is $3\frac{1}{2}$ in. long and $\frac{1}{2}$ in. wide; this is the correct size for a normal cigarette, allowing, of course, for the width of the groove in the vertical member *h*. The sides of the two boxes A and B are about $\frac{3}{16}$ in. in thickness; the top cover of A and the base of B are $\frac{1}{4}$ in. in thickness.

Materials.—There is a choice of materials, or woods, for this cigarette box; mahogany, walnut, cedar, sandal-wood, and satin-wood being suggestions. Fig. C is a central cross-section, taken through the longer dimension of the box. Note the small cross-pieces *m*, fixed to the lower part of A; when A is raised these pieces come under the projections *n* and thus prevent A from being lifted off. Fig. D shows the idea rather more clearly. In assembling the two parts A and B, the base of B is the last and members *m* are next but last in order of fixing.

CINDER SIFTER

The cinder sifter shown in Figs. A and B is a novelty and is suitable for use indoors as well as outside. It is easily made, machine-planed wood can be used, and there are no elaborate internal details to be fitted. The arrangement can be followed in the section given in Fig. C.

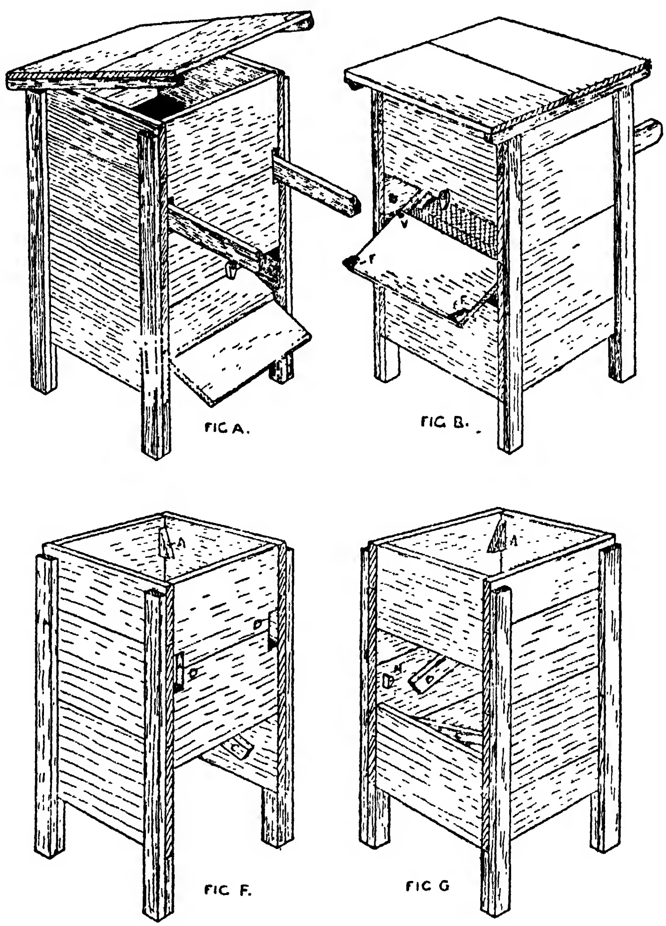
Method of Using.—The cinders as gathered from the hearth are poured in through the open top, and fall on to a sifter formed of close-woven wire netting. The sifter is thoroughly shaken by pushing the handle down and up a few times; this will allow the fine ashes to fall down. The sifted cinders are removed by unbuttoning the flap as shown in Fig. B; this will allow the sifter to fall to the same slope as the flap when it is open, and the cinders will fall out into a box or bucket placed in front of the opening. To remove the fine ashes, the flap underneath the handle is opened and allowed to fall, and the ashes will slide out at once.

The Sides.—All the main dimensions are shown in the side section in Fig. C and the front view in Fig. D. Other sizes are given in the separate details. Begin by making the two sides, as shown in Fig. E, nailing 15 in. long strips of $\frac{3}{4}$ in. boarding to 33 in. lengths of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. wood. The strip at the top should be about 5 in. or so wide and project 1 in. above the uprights, the next two 9 in., leaving a strip of $4\frac{1}{2}$ in. to complete the boarding. The two portions, when the boards have been nailed together, should be placed side by side so that the marks for the projecting pieces on the inside can be made alike on both pieces.

First prepare four pieces of wedge form from $\frac{3}{4}$ in. thick wood, as shown at A. These measure $1\frac{1}{2}$ in. at the base, and are just over $3\frac{1}{4}$ in. high. They are nailed on 4 in. down and $\frac{3}{4}$ in. away from the outside edges. Next prepare two pieces of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. wood to $11\frac{1}{2}$ in. Nail one piece

as at B with the top corner $11\frac{1}{2}$ in. down from the top and $\frac{3}{4}$ in. away from the outside, and the bottom corner $5\frac{1}{2}$ in. below or 17 in. from the top. The outside corner is now sawn off parallel with the outside, as shown. A similar length of wood is now nailed on 20 in. down from the top and $\frac{3}{4}$ in. from the opposite side as at C; the lower edge is $4\frac{1}{2}$ in. below and the upper corner sawn off parallel with the outside as before.

Back and Front.—The pieces for the back and front are all $13\frac{1}{2}$ in. long and $\frac{3}{4}$ in. thick, two strips making a total width of 11 in. being nailed on from the top at the back. If some 11 in. wide board is available, all to the good. From the bottom, nail on a strip $8\frac{1}{2}$ in. wide, leaving an opening of 8 in. In the front the whole is boarded in to a depth of 19 in. but two openings D, 1 in. wide, and $3\frac{1}{4}$ in. high, $8\frac{3}{4}$ in. from the top must be allowed for. The openings are enlarged on the outside to allow for the handle movement, as indicated in the section in Fig. C. If two boards, each $9\frac{1}{2}$ in. wide, are available, it will be a simple matter to cut the slots.



External Appearance of Cinder Sifter showing how the Main Body Portion is made.

To complete the carcase, nail on four $6\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. strips at the bottom of the strips on the side pieces to form $1\frac{1}{2}$ in. square legs, as indicated in the diagrams in Figs. F and G, which show the work carried to this stage.

The Bottom.—The bottom board E is now prepared so that it fits between the sides, is planed off to the required angle front and back, so that the edges are in a line with the front and back boards. The wood is now nailed to the inner strips already secured to the inside as at C. Two

$4\frac{1}{2}$ in. wide strips of $\frac{3}{4}$ in wood sawn to $13\frac{1}{2}$ in. long are nailed to the blocks at A, the top and bottom edges being previously planed to the necessary angle for them to fit correctly. The two openings are now fitted with boards, that for the cinder-shoot being $13\frac{1}{2}$ in. by 8 in. by $\frac{3}{4}$ in., with strengthening battens 7 in. by $1\frac{1}{2}$ in. by $\frac{3}{4}$ in., screwed on from the front; a distance of $1\frac{1}{2}$ in. from the outer edges will do. Two stops, 2 in. by 1 in. by $\frac{3}{4}$ in. having the lower corner cut off, are now screwed to the top corners of the flap, as indicated at F.

The Flap.—The flap is now fitted in place and holes are bored or drilled through the end pieces 2 in. up and 3 in. from the outside and either screws or stout wire nails being driven in as pivots, as shown at G. A small wooden button is now cut from a piece of hard wood and screwed above the flap as at H; this will keep the flap up in position. The flap for the ash shoot is $13\frac{1}{2}$ in. by $8\frac{1}{2}$ in. by $\frac{3}{4}$ in., with two battens 8 in. by $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. screwed on $1\frac{1}{2}$ in. from the outside edges. The flap is secured by two pivots 2 in. up, fixed in the same way as the other opening and shown at K; the top is also secured by a button as at L. To prevent the flaps being pushed in too far, a strip of wood is screwed to the top edge inside. It should be $13\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{3}{4}$ in., and project $\frac{1}{2}$ in. below the ash shoot opening, as at M. A similar strip above the cinder-shoot opening would not allow the sifter to fall, but stops, made of $\frac{3}{4}$ in. square wood about $1\frac{1}{2}$ in. long, can be screwed on at N.

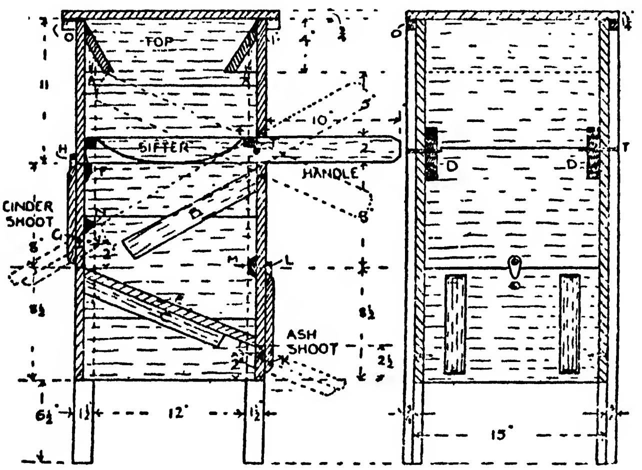


Fig. C.—Side Sectional View. Fig. D.—Front Sectional View.

The Top.—The top of the carcase is made of $\frac{3}{4}$ in. thick wood with a projection of 1 in. on all sides. On two sides a 17 in. by 1 in. by 1 in. strip is screwed on as shown at O. The top is hinged with ordinary butt hinges to the back, the hinges being let in the wood to half the thickness of the knuckle in each case.

The Sifter Construction.—It now remains to make the cinder sifter as shown in detail, with separate parts, in Fig. H. First prepare the two handle lengths to $24\frac{1}{8}$ in., cut a notch 1 in. long and 1 in. down at the end of each piece, and $11\frac{5}{8}$ in. away cut a slot 1 in. by 1 in. by $\frac{3}{4}$ in., as indicated at P. Prepare one $13\frac{1}{2}$ in. by 1 in. by 1 in. length for the end as at Q, and another 1 in. by 1 in. strip, 12 in. long, to fit in the slots at P.

Screw these pieces to the handle lengths, and then trim off the ends as shown at R; this is to allow free swing to the sifter.

The Wire Netting.—The wire netting used should be about the same mesh as the average round cinder sifter; it should be wide enough to fit between the sides and long enough to wrap over the cross-pieces and allow for a dip in the centre. Two curved strips as at S should be prepared to $11\frac{3}{8}$ in. by 2 in. by $\frac{3}{4}$ in., and these should be placed on the inside of the opening, nailed to the handle lengths, and will also supply a good surface for attaching the netting. The curved strips are useful in stretching the netting, as well as giving the necessary curve to the sifter. The ends of the handles are now trimmed off, and then the cinder flap can be opened and the sifter pushed into its place, and will rest on the catches F. Holes are now bored or drilled and 3 in. nails or screws driven through to form the pivots at T. Care should be taken when pivoting the sifter to make sure that the inside moves freely. The cinder flap is now opened and two screws driven in each side to keep it at the correct angle as indicated at V. The woodwork should be coated with a wood preservative or painted. Wooden or metal knobs should be screwed to the top of the flaps as shown in the diagrams.

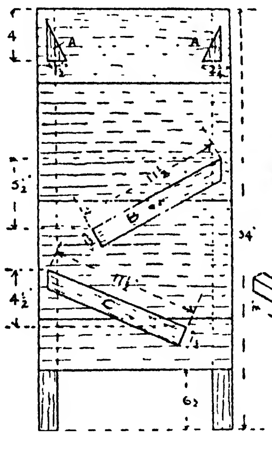


Fig. E.—Method of making Sides of Sifter.

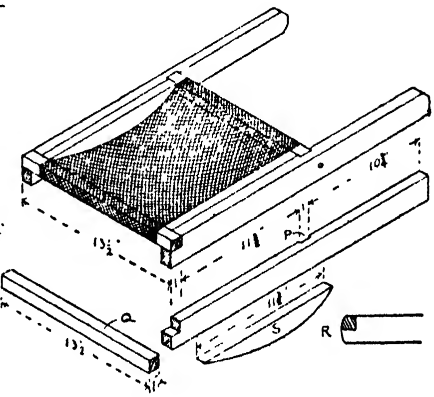


Fig. H.—Some Constructional Details.

CLOTHES RACK

The clothes drying rack (Fig. C) is one of those helpful devices which can be used where the space is limited. As many arms can be used as necessary and when not in use it can be folded up into very small bulk and put into a corner (Fig. E).

Construction.—The pole is made of 2 in. by 2 in. deal, the four posts and four rails of 1 in. by $\frac{5}{8}$ in. deal. The two soles, $3\frac{1}{2}$ in. by 1 in., and the four stays, $3\frac{1}{4}$ in. by $\frac{5}{8}$ in. timber.

Begin by planing up the pole and marking off the shape of the top end.

The positions of the two rails which open out in the one line are 18 in. from the ground and the others are the same distance higher up.

The rails which open out at right angles to those are all $\frac{3}{4}$ in. lower than the first.

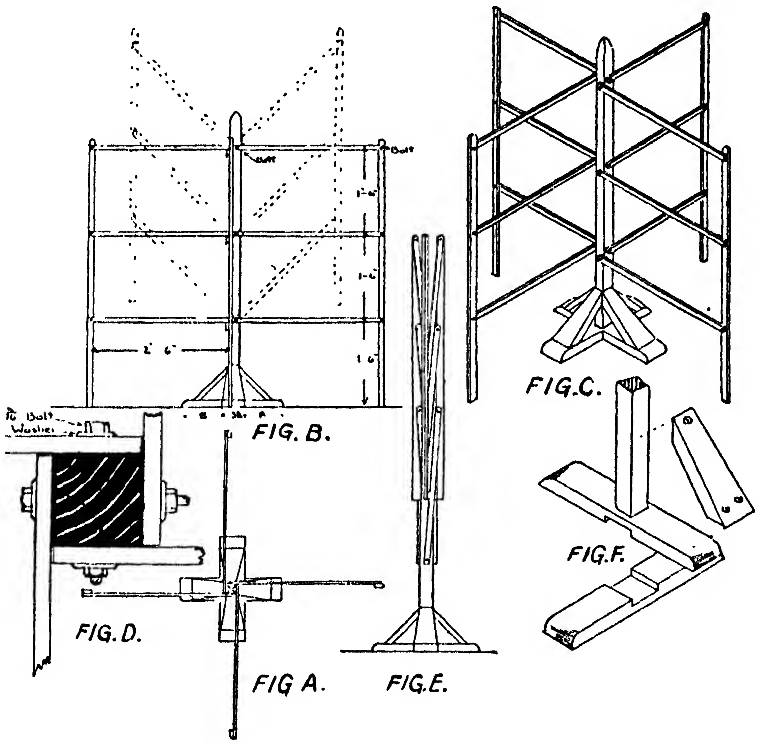
The reason this arrangement is made is to allow the bolts to pass through the pole without interfering with each other.

Bore the holes, Fig. D, and proceed with the shaping of the top end.

The sole piece for the pole is shown at Fig. F.

The two cross-pieces are half checked and rounded at the end.

Taper the four stay pieces to 2 in. at the top end, then cut the top and bottom bevels to form a right angle and bore for the screw nail, (Fig. F). Fix the cross-pieces of the sole together and fix the pole by screwing from the under side.



Constructional Details of Clothes Rack.

Set the pole in a level position and fix it vertically both ways, then proceed to screw the stays in position as shown in Fig. C. Take the pieces which are to form the posts and round off the top ends. Draw in the position of the holes for the bolts off the posts.

The rails are all the same length; after marking the position of the bolt holes, draw from the same centre a $\frac{1}{2}$ in. radius.

The framing is now ready to be bolted together. Give each piece a final polish with fine sand-paper and in bolting together use a washer on each end of the bolt.

A coat of stain and varnish would add much to the appearance and value of this unique kitchen device.

CLOTHES STAND OR DUMB VALET

The clothes stand shown at Fig. A is designed to provide a convenient stand to take a coat and vest, trousers, shirt, collar, tie, socks and shoes in an orderly manner. The principal dimensions are given in the front and side views in Fig. B.

Constructing the Framework.—Begin by making the framework, as shown in Fig. C, by preparing the two uprights A and B, and the back upright C. All these pieces are prepared to $1\frac{1}{4}$ in. wide by $\frac{3}{4}$ in. thick, and although yellow deal is quite suitable, a nicer piece of furniture will result if a hard wood, such as mahogany, walnut, or oak, is used. The uprights A and B are cut off quite square at the ends to 30 in. long, the back upright being $6\frac{3}{4}$ in. longer. Join the uprights A and B together by two rails, each 17 in. by $1\frac{1}{4}$ in. by $\frac{3}{4}$ in., using the simple dovetail at the top and the mortise and tenon at the bottom. The method of forming the top dovetail is shown in Fig. D, and consists in marking off the exact length of the rail 17 in., and leaving $\frac{1}{4}$ in. waste at the ends. Set off $\frac{3}{4}$ in. from the end marks, and mark off the dovetails and cut them to shape with the tenon saw. The socket for the dovetail is marked off by placing the dovetail on the top of the uprights and outlining the shape with a pencil. Saw to the pencil lines to a depth of $\frac{3}{4}$ in. and then cut out the waste with a chisel.

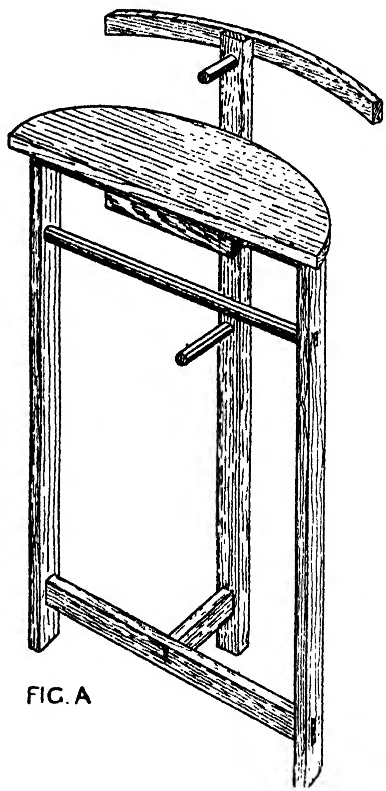
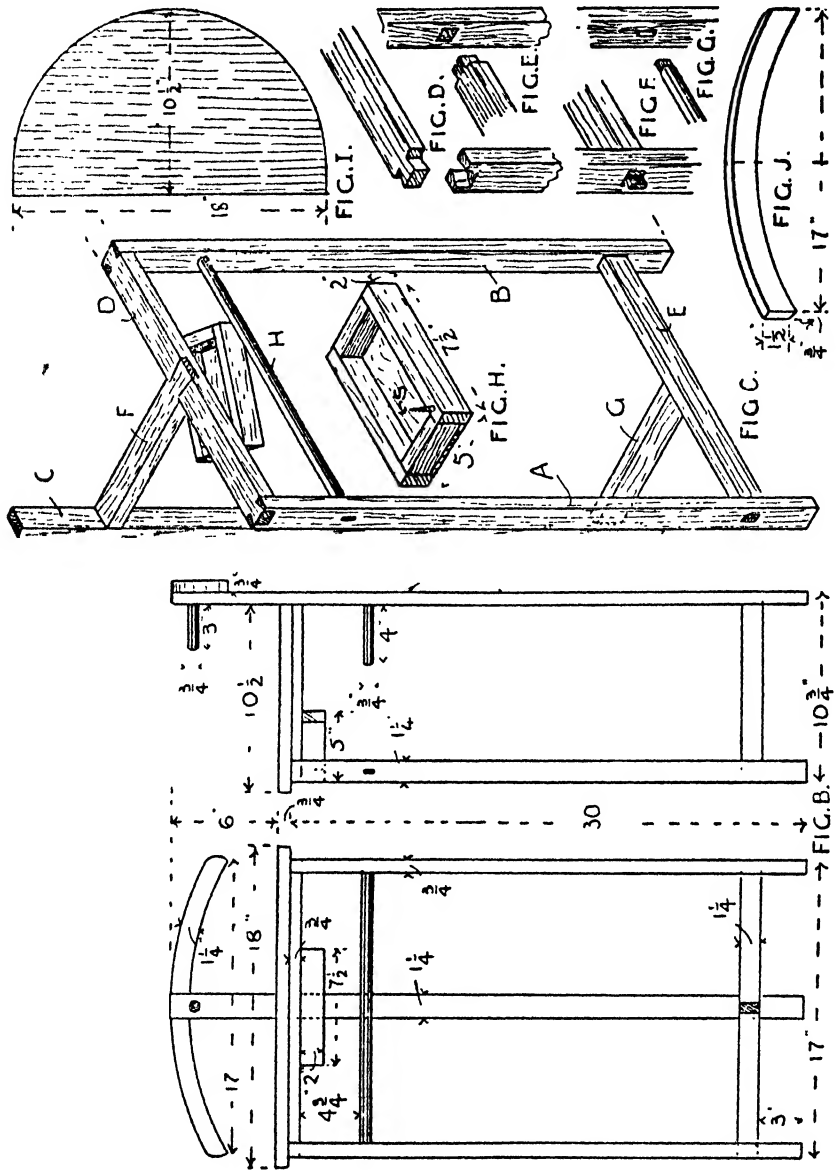


FIG. A

Fig. A.—The Completed Dumb Valet.

Cutting the Tenons.—In cutting the tenons on the bottom rail, set off a distance equal to the exact distance between the shoulders of the top piece, then mark off $\frac{1}{8}$ in. each side to give a tenon of $\frac{1}{2}$ in. in thickness. Mark this distance in the centre of the uprights 3 in. up from the bottom, and then saw the tenons and cut out the mortise with a suitable chisel. In order to make a really strong joint, the tenon should be sawn across, the outside of the mortise widened, so that a wedge can be inserted when gluing up. The next thing is to prepare two cross-rails F and G, to attach the front frame to the back upright; these are prepared to 11 in. by $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. In the case of the top cross-rail, the front joint is a simple dovetail prepared as before, but carried down half-way only, the back joint is a wedged mortise and tenon, as shown in the detail at Fig. E, and also with the wedge in

position at Fig. F. The exact distance between the shoulders of the top cross-rail is 8 in. The bottom cross-rail G is tenoned into the back upright as well as into the bottom rail E, but the distance between



Dumb Valet

Dimensions and Constructiona

the shoulders should allow for the position of the front rail, as it is upright and set back ½ in., and is therefore 8¼ in. The round rail at H is an 18 in. length of ¾ in. diameter dowelling, tenoned at the ends, as shown in Fig. G, and let in a mortise cut through the uprights

A and B, 4¾ in. down from the rail D. The frame is then glued together.

The Drawer and Top Shelf.—The next job is to make the swinging drawer, as shown at Fig. H; it is formed with two sides, 7½ in. by 2 in. by ¾ in., two ends 3½ in. by 1¾ in. by ¾ in., and a base 7½ in. by 3½ in. by ¼ in. These pieces should be planed to size carefully, then glued and screwed together to form a shallow box. At a distance of 1 in. from the left-hand end of the front piece, bore a hole to take a 3 in. screw, as shown at S; this forms the hinge.

The top shelf (Fig. I) of the stand is cut from a length of 11 in. by ¾ in. wood cut off to 18 in. The shelf is now screwed in position from the under sides of the two rails F and G, and when this is done the swinging drawer can also be screwed in position.

The Coat Hanger.—The coat hanger is shown at Fig. J; it is 17 in. long and ¾ in. thick, with a width of about 1½ in., the radius of the curve being 17 in.

The finished work should be cleaned up with fine glass-paper and polished; for amateur use there is nothing simpler than wax polish for hard woods, but if deal or some other white wood has been used, the most suitable finish is oil varnish stain.

COAL BUNKER

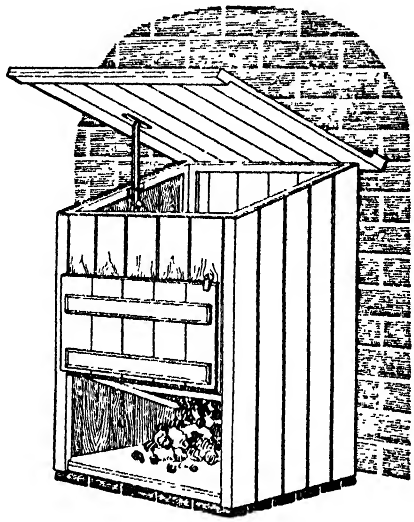
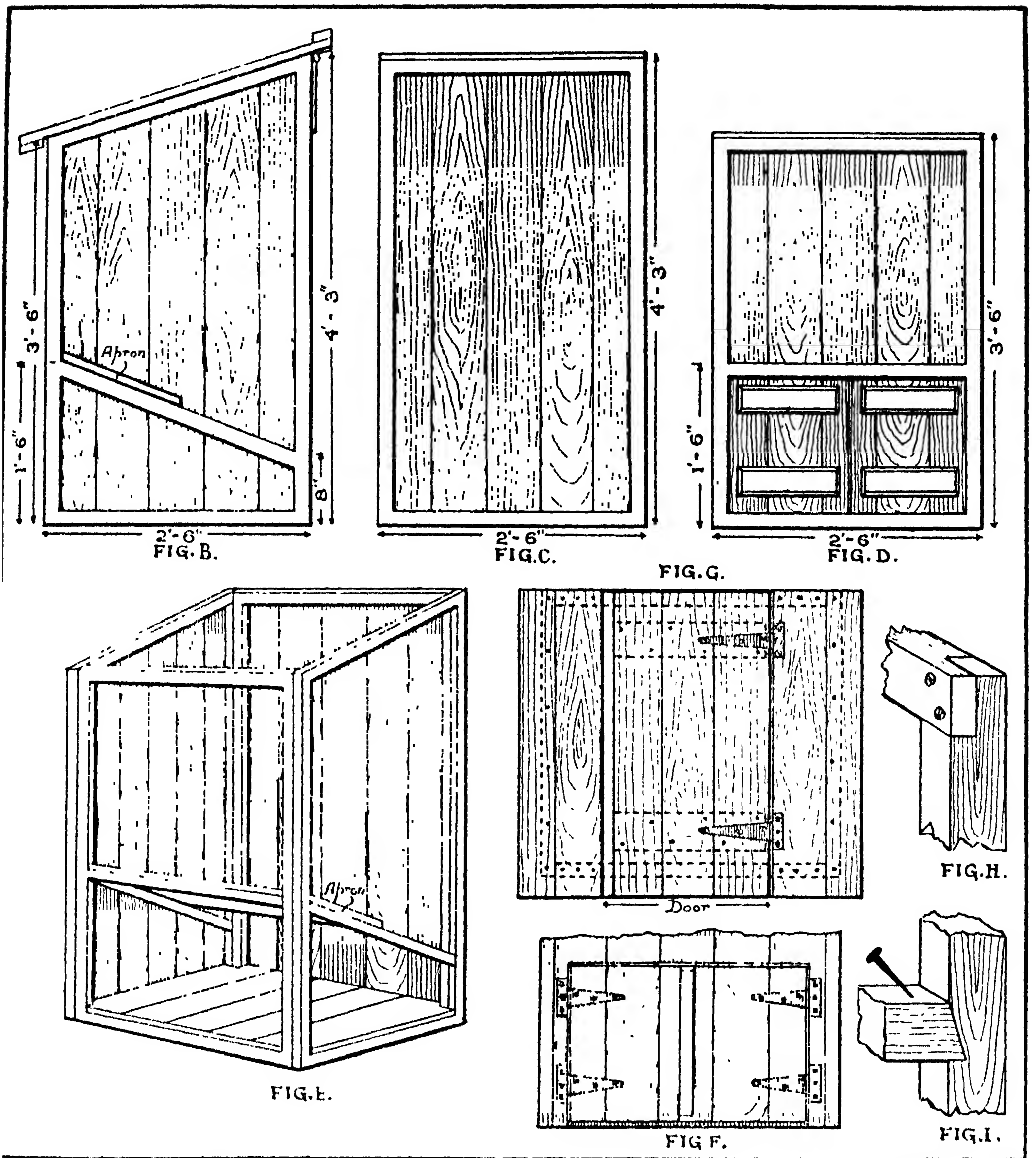


Fig. A.—Showing the Finished Coal Bunker.

The great fault with the ordinary coal shed is that the coal delivered last gets used first, and as time goes on all the small coal and dust gradually settle in the bottom. With the coal bunker shown by Fig. A, the coal is delivered through the top, and shovelled out at the bottom.

The bunker is made in sections which are framed up and covered with boarding. The side and back pieces of framing are entirely covered with the boarding; there is an opening at the bottom of the front to which a door or doors are fitted; above this opening is a sloping apron which causes the coal to drop down in sufficient quantity to be easily shovelled out and also deflects it away from the door. The top is hinged to open for the delivery of the coal. The bunker may be made to almost any size, the only considerations to be kept in mind are that the height should not be increased to interfere with the easy delivery of the coal, and that the larger the bunker the greater the strength required. A bunker of the size shown will meet the needs of an ordinary household where there is a frequent delivery of coal.



Constructional Details and Dimensions of Coal Bunker.

The Framing and Boards.—The framing should be of deal scantling $1\frac{1}{2}$ in. or 2 in. square. There will be two sides similar to that shown by Fig. B, framed with two uprights and top and bottom rails, half lapped and screwed together as in Fig. H. In addition there is the sloping rail which carries the apron; this is framed in the position shown, but it only needs to be notched into the uprights and nailed as shown in Fig. I.

In the back there are two uprights and top and bottom rails framed up as shown in Fig. C. In the front there are two uprights and top and bottom rails framed up as shown in Fig. D, and in addition there is a middle rail notched into the uprights on a level with the front ends of the sloping rails in the sides.

The four pieces of framing are bolted or screwed together as shown by Fig. E, the front and back fitting within the sides. The bottom may be covered with 1 in. boards nailed over the bottom rails of the framing, the apron is of 1 in. boards nailed over the sloping rails, and the sides, back, and front are covered with 1 in. boards nailed to the framing.

The Door.—There may be a single door at the bottom, as shown in Fig. A, made from the 1 in. boarding and battened. This door would be hinged at the top, and a wood turn-button should be fitted to the front of the bunker to hold the door when open. Another plan is to fit a pair of doors as shown in Figs. D and F. These would be made from the 1 in. boarding and battened, and hinged at the sides; the left-hand door being fastened with a bolt; a slip is nailed to the right-hand door to cover the meeting edges, while a turn-button or padlock should be fitted to fasten it.

Roofing.—The roof may take the form of a single door, as shown in Fig. A, made from the 1 in. boards, battened under at the front and above at the back. This door would be hinged at the back, and when open could be held by an iron stay. Another method of forming the roof is to nail down the boards at each side, and to provide a door about 1 ft. 6 in. wide in the middle, as shown in Fig. G. The door should be battened on the under side, hinged at the right-hand side, and a slip should be nailed at the left-hand side to cover the meeting edges.

COAL CABINET

The coal cabinet described here will be found to be an improvement on the old-fashioned box, and in some respects it is preferable to the cauldrons now in use.

The construction is as follows :

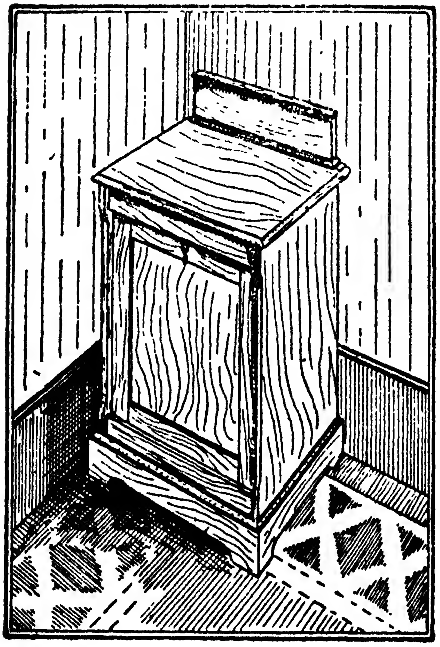
The Carcase.—Prepare the sides from 1 in. stuff, and if jointing is necessary, as it most probably will be, use three or four dowels.

Now frame up the carcase, as shown in the details, Figs. E and F. The piece A should be dovetailed into the side at A^1, within $\frac{1}{4}$ in. of its width, and not be flush with the edge, but $\frac{3}{8}$ in. from it. The same method of jointing is duplicated for the bottom of the carcase, but not for the back. The piece B, as seen in Fig. E, is dovetailed as shown, being quite flush with piece A to ensure rigidity; there are four of these pieces and the method of jointing is identical in each case, but the top and bottom pieces for the back of the carcase, instead of being flush with pieces similar

to A, are flush with the panelled back, as shown in Fig. F, C being the piece dovetailed, and D the panelled back.

The back should now be made from $\frac{3}{4}$ in. stuff and 2 in. wide. These should be mortised and tenoned in the usual way, and a groove ploughed in the inside edges to take the panel. This panel could be made from three-ply wood. Both sides of the carcase and the inside edges of the back should be rebated; this gives added strength and ensures rigidity.

The carcase is now complete, but should not be glued together, for the pivots, Fig. K, have to be fitted, and before doing this it is advisable to make the box. A few screws through the back into the sides will, if the joints are good, make the carcase absolutely firm and rigid.



The Finished Coal Cabinet.

The Plinth.—The correct joint to use in fitting the sides to the front is shown in Fig. D. The front and two sides are prepared from $\frac{3}{4}$ in. stuff to finish $\frac{5}{8}$ in., and are dovetailed together at the two front corners. A strut is halved, dovetailed $1\frac{1}{2}$ in. from the back, and this is also shown in the sectional elevation, Fig. C. Make sure this is square by measuring the diagonals of the inside rectangle. The strut, which is $1\frac{1}{4}$ in. wide, can be made from deal, but the framework should be made from plain oak. This framework should now be faced with $\frac{3}{16}$ in. oak, and mitred at the corners. This is a much more satisfactory way of dealing with the plinth, as, if anything, it is stronger than the secret dovetail, and also a far better joint is secured at the corners.

The two pieces of moulding 2 in. wide by $\frac{1}{2}$ in. thick can now be mitred and pinned into place. These pieces are shown in the sectional elevation F, Fig. C, and resting on the framework of the plinth. The shape of the bottom of the plinth as seen in the elevations, Figs. A and B, can now be cut.

The Top.—The top is $\frac{3}{4}$ in. thick, and projects from the carcase $\frac{3}{4}$ in. all round, except at the back, and there it projects an inch (to allow for the skirting board). If two pieces have to be joined, dowels should be used. A simple thumb moulding is worked on the two sides and front; a section of this moulding is shown in an enlarged detail. The top is fastened to the carcase by means of buttons in the usual way.

The ornamental backing for the top is shown in Fig. G. The sizes for this can be seen quite readily in the elevations, Figs. A and B.

To prevent the screws being seen when screwing on the top moulding, let in the screw for ⅛ in., and cover with flush buttons as illustrated.

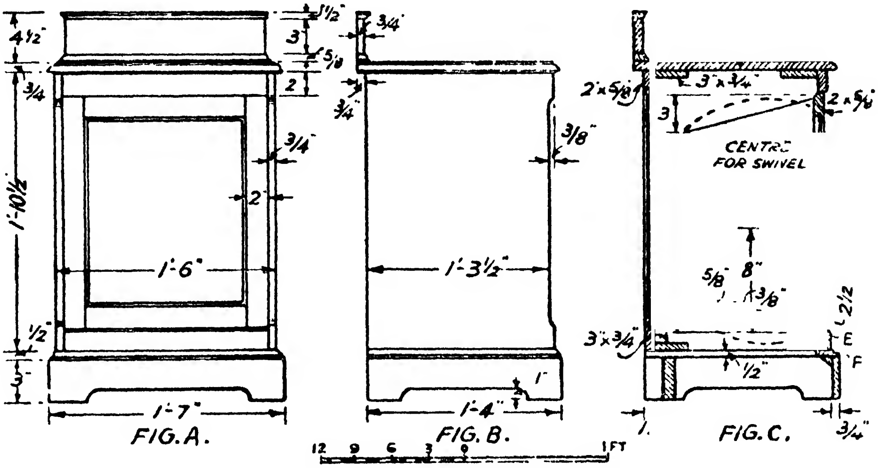
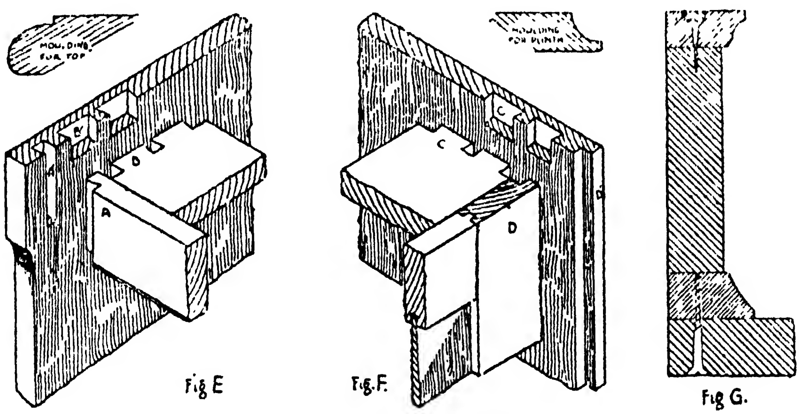


Fig. A.—Front Elevation. Fig. B.—Side Elevation. Fig. C.—Sectional Elevation.

The Box.—First make the panelled frame for the front similarly to the panelled back, with one exception. The bottom piece should be ½ in. wider than the top piece, for whereas the top piece just touches the piece A in Fig. E the bottom piece stops against the other piece



Figs. E and F.—Framing up the Carcase. Fig. G.—Section through Ornamental Back Panel.

E in the sectional elevation, Fig. 3, and so this ensures a view of equal framing when the box is closed. The panel is grooved, and can either be quite plain, as in Fig. I, or a wide bevel made as in the detail, Fig. H.

The sides should now be dovetailed as shown in Fig. H; the measurements of these sides are shown in the sectional elevation, Fig. C. The back should now be dovetailed to the sides.

As shown in the sectional elevation, Fig. C, the back does not go right to the bottom, but stops within 1 in. of it. This is to allow for the bottom

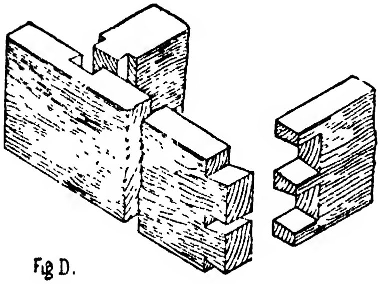


Fig D.

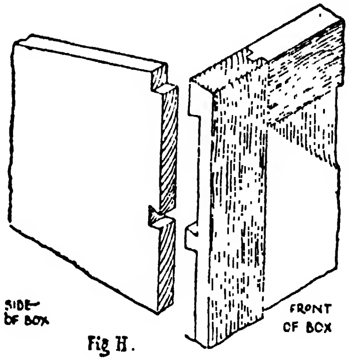


Fig H.

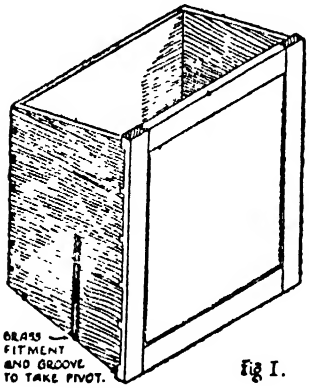


Fig I.

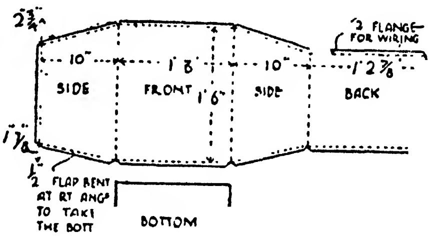


Fig J.

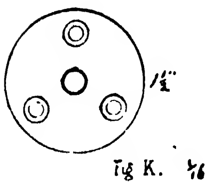


Fig K.

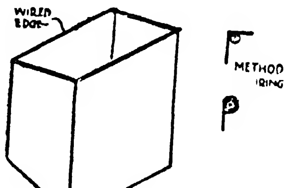


Fig. M.

Fig. D.—Method of building up the Plinth.
Fig. H.—Details of Corner of Box.
Fig I.—Isometric View of the Box showing Fitting.

Fig. J.—Development of Galvanised Iron Box.
Fig. K.—Pivot to hold Box.
Fig. M.—Isometric View of Galvanised Box.

to slide in its groove, and a couple of screws can then be screwed up into the back. The screws should be slotted to allow for shrinkage.

The box is now complete and ready for the brass fitment to take the pivot, Fig. I. The centre about which the box is to swing should be

very carefully measured, Fig. C, and a hole bored right through the two sides with a bradawl. The box can now be held in its correct position inside the carcase, and the centre where the pivot is to be fitted can then be accurately marked.

Fittings.—The two centres now being found, the brass fitments, which can be made from hard brass, consist of two pieces $8\frac{1}{4}$ in. long by $1\frac{1}{4}$ in. wide, a slot $\frac{3}{8}$ in. wide down the centre, and a hole $\frac{3}{8}$ in. in diameter bored at the closed ends, Fig. I. This is let into the sides of the box, and a groove cut in the sides $\frac{1}{4}$ in. to $\frac{3}{16}$ in. deep, to take the pivot, Fig. K. One or two screws to hold the fitment in position is all that is necessary.

The Pivot.—As seen in Fig. K, this consists of a circular piece of iron or brass with a cylindrical piece riveted in. This is the piece over which the slotted side runs, and finally comes to rest in the circular hole. The pivot should be let into the inside of the carcase at the place marked, quite flush, but, for safety, a little below the surface.

Assembling.—The whole job is now ready for gluing up, cleaning, and polishing.

Galvanised Iron Box.—The development of this box (Fig. M) is shown in Fig. J. Two movable handles soldered on to the sides will greatly facilitate the handling of the box. A space between the wooden box and the panelled back, Fig. C, can be utilised to accommodate a small shovel.

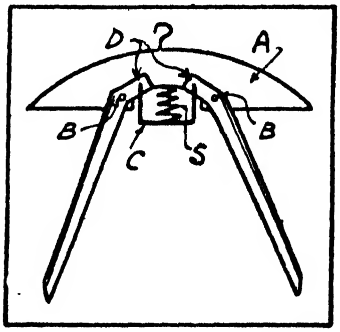
To prevent the box opening too far, a small stop may be affixed inside one of the sides of the body.

A small bullet catch to keep the box in place and a drop handle to open and close the box will put the necessary finish to the article.

COAT HANGER AND STRETCHER

A useful combined coat-hanger and trousers stretcher is made as follows :

A is the coat hanger, to which are fixed four thin strips of wood (two on each side of A, back and front, opposite each other), so that they will move freely at the points B.



Coat Hanger and Trousers Stretcher.

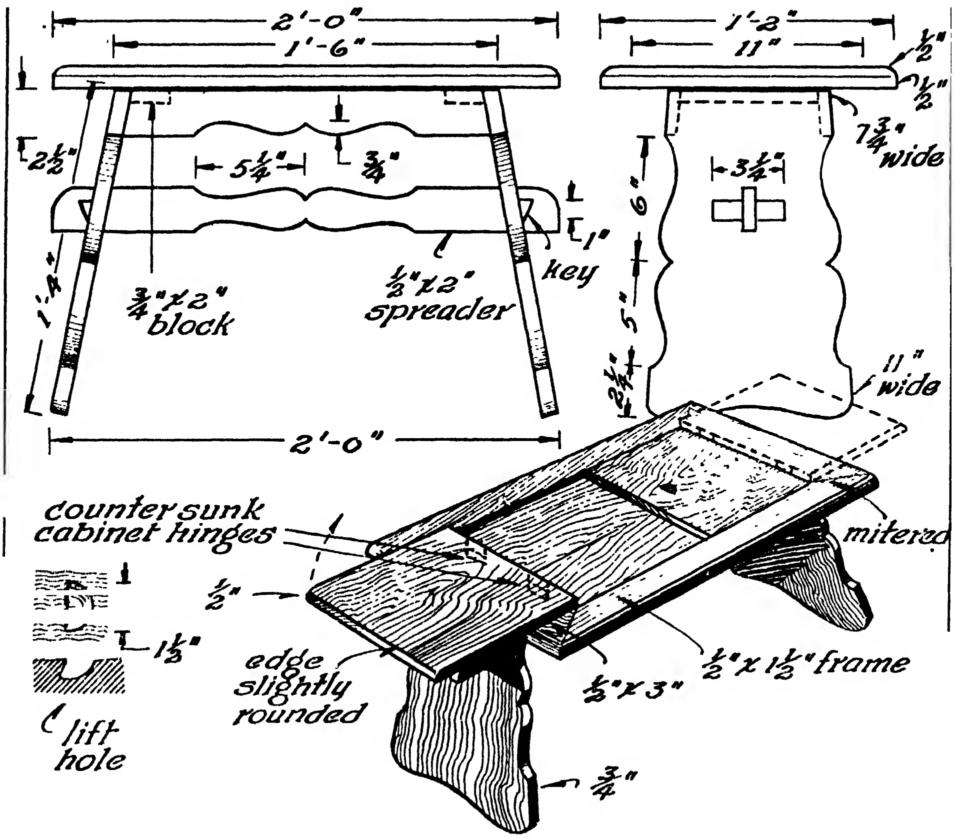
A strong piece of wire C, bent square, is fixed to the strips of wood at D (a piece of wire on each pair of strips back and front).

A strong spring S is inserted and fastened to the under side of the wood A, the other end being fastened to a cross-bar which joins the two pieces of wire C. The thin strips of wood are bevelled on their outer side. If the strips of wood are brought towards one another, the spring tends to thrust them apart.

If each pair is inserted in a trouser leg, by virtue of the spring thrusting them apart a permanent crease is obtained.

COFFEE TABLE, PROVENÇAL PATTERN

To construct the attractive and useful table illustrated herewith, glue ½ in. stock together to form a top piece 14 in. wide and 24 in. long when finished. From ½ in. finished stock cut 4 pieces to form a frame around the table top. Two of these boards are 3 in. wide and 14 in. long, for the ends, and two are 1½ in. wide and 24 in. long for the sides. Mitre the



Provençal-pattern extending Coffee Table.

corners and glue the frame to the table top, securing the ends at each corner with a short screw from the under side of the top. Each leg is cut from ¾ in. finished stock with scroll edges, being finished as shown in the drawing. The legs taper from a width of 7¾ in. at the top to 10 in. at the bottom, the upper ends being bevelled to fit against the top and spreading the legs so that they measure 2 ft. across the bottom. Each leg is 16 in. long. Attach blocks ¾ in. thick, 2 in. wide and about 6¾ in. long to the under side of the top, using countersunk screws. Cut and finish the two

aprons as shown to fit between the legs at front and back, attaching with round-headed screws to the $\frac{3}{4}$ by 2 in. blocks. The spreader is cut as shown from a board $\frac{1}{2}$ in. thick, 2 in. wide and 24 in. long. Cut slots in the legs to take the ends of the spreader which are anchored with triangular keys cut out as shown and glued in triangular holes cut in the ends of the spreader. The folding leaves of the top are finished $\frac{1}{2}$ in. thick, 11 in. long and 9 in. wide, to fit inside the frame. Attach the leaves to the inside of the end frame boards with countersunk hinges so that the upper edge of the folded hinge does not protrude above the surface of the frame, permitting the leaves to fold flat and level. Lift holes are tooled in each leaf so that it can be lifted easily. When used as an occasional table, the leaves are folded, presenting a flat surface for books or magazines. When opened for tea or lunch, the leaves afford extra surface for the tea service or for plates, while the recessed top surface is used for most of the tea service. The adjoining ends of the folded leaves should be slightly rounded so that they will not catch. The table top is finished with spar varnish, which can also be used on the remainder of the table if mahogany, walnut or oak is used. If maple is used, finish with spar-varnish top.

COT, WOODEN, WITH DROP SIDE

The cot shown at Fig. A is of simple construction and may be made in any suitable wood to match existing furniture. In order to keep the construction as strong as possible it is not advisable to have both sides to let down: one side as shown at Fig. A is quite sufficient. The main dimensions are given in the side view at Fig. B, the end view at Fig. C, and the plan at Fig. D. The two ends of the cot are made, first the uprights, $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. and 36 in. high, the top rail 2 in. by 1 in., and the bottom 4 in. by 1 in., both rails being 21 in. between the shoulders. The joints are shown

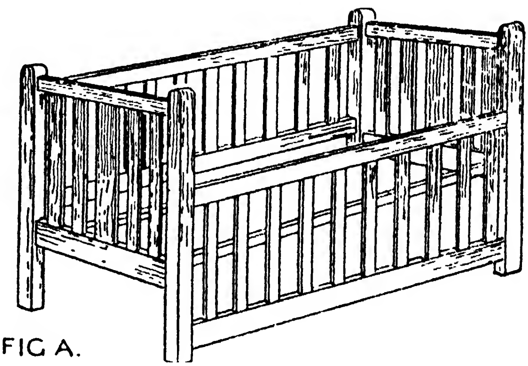
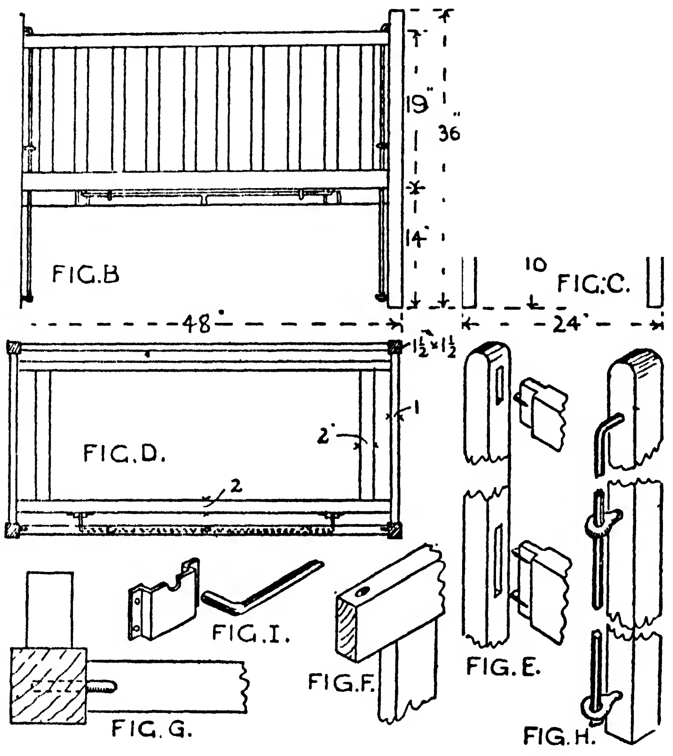


FIG A.

The Completed Wooden Cot, with Drop Side.

in Fig. E, the tenons being $1\frac{1}{4}$ in. long and about $\frac{1}{2}$ in. thick, wedges being used as shown. It should be noted that in using wedges the inside of the mortise should be widened at the base to allow for the outward spread of the tenon when driven home. The upright laths between the rails may be the same thickness as the rails, but generally they are thinner: $\frac{3}{4}$ in. will be sufficient. The fixed rails of the cot should be tenoned in in the same way as the end rails, both the side rails being 2 in. by 1 in. and 45 in. between the shoulders. The sliding or let-down side should be composed of two rails 45 in by 2 in. by 1 in., with laths

joining them and tenoned in. The ends of the rails are bored to take the two lengths of iron rod as shown at Figs. F and G. The rod is shown to an enlarged scale in Fig. H: it is 34 in. long and $\frac{3}{8}$ in. diameter. The top of the rod is bent at a right angle for a length of $2\frac{3}{4}$ in.; of this length $1\frac{1}{4}$ in. enters the wood, leaving $1\frac{1}{2}$ in. outside away from the side upright The rod is held in position by two screw-eyes, one half-way and the other at the bottom. These screw-eyes should be chosen carefully as they should be an exact fit for the rod. The method of fixing the let-down side in position is shown in Figs. B and D, and comprises a sliding rod which rests on two sockets as at Fig. I. The rod should be $\frac{5}{8}$ in. diameter and about 36 in. long, the ends being bent at right angles as shown, and a handle welded or brazed on in the centre. If the rod is supported by screw-eyes to the lower rail of the side, and the sockets, made of iron or brass, screwed to the side lath, the length of the right-angle bend can be made to correspond. The side and end laths shown in the plan are tenoned together and to the end lower rails. As there are several methods of forming the mattress, this portion of the cot is left. Cross-laths can be fitted between the long side laths, or a wire mattress rested on the frame.



Constructional Details and Dimensions of Drop-side Cot.

CUPBOARDS

In the small house one has to make the most of the available space, and generally in bedrooms it is possible to provide a simple built-in cupboard or wardrobe in the recess formed by the projecting jambs of the fireplace. Another favourite device is the provision of a cupboard in the corner of a room, this, also, very often taking the place of the usual portable wardrobe.

The construction of both these types of cupboards is described in the following article.

A Recess Cupboard.—Dealing with the recess cupboard first, it will be found that this consists of two doorposts, each 3 in. by 2 in., cut at the back to fit the skirting and plugged to the walls. The tops of these posts are cut to mitre with a 3 in. by 3 in. lintel or top piece, and firmly nailed together. Fillets, 2 in. by $\frac{3}{4}$ in., are fixed—inside the press—to the walls round the three sides, and the $\frac{5}{8}$ in. top nailed on to these fillets and to the lintel. A $2\frac{1}{2}$ in. by 2 in. moulding is then nailed across the front, as shown in the enlarged section, and returned at one end, the other end being butted against the wall, as depicted in the elevation.

Below the top, at a distance of 18 in., is fixed a shelf $\frac{7}{8}$ in. thick, supported on $3\frac{1}{2}$ in. by $\frac{3}{4}$ in. belting or backboards, to which are screwed the hooks for hanging purposes.

To the inner side of the doorpost, opposite the post on which the door is hinged, is fixed a $1\frac{5}{8}$ in. by $\frac{5}{8}$ in. door stop. This stop is illustrated in enlarged sections, *x-x* and *y-y*.

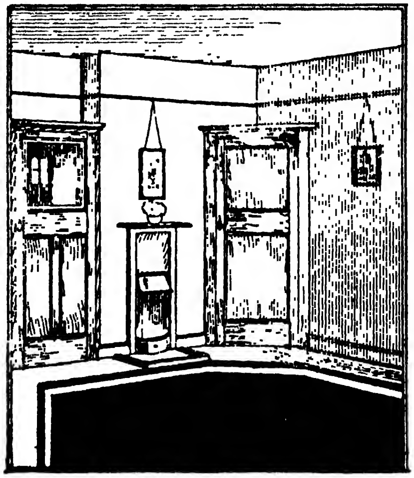


Fig. A.—(Right) Corner Cupboard. (Left) Recessed Cupboard.

The door is $1\frac{3}{8}$ in. thick in three panels, the top panel having a mirror fitted, as shown in enlarged section *x-x*. The lower panels are three-ply fixed as in section *y-y*. The door is hung on a pair of 5 in. hinges, and fitted with a press lock and handle of a selected design.

The Corner Cupboard.—With regard to the construction of the corner cupboard, two bevelled fillets or battens out of 2 in. by 1 in. wood are first plugged or nailed to the wall behind the front frame at each side of same. These fillets are shown on the enlarged plan at A, and are the same height as the front frame. The latter is then made, and consists of two $4\frac{1}{2}$ in. by $1\frac{3}{8}$ in. thick uprights cut to fit the skirting, and a top piece or lintel of similar scantling tenoned into the uprights, as illustrated in enlarged detail at B. This frame is then screwed to the 2 in. by 1 in. upright fillets.

The top, moulding along front of same, shelving, belting or backboards and hooks are all fixed in similar fashion to that described for the recess cupboard.

The door is $1\frac{3}{8}$ in. thick, with two panels, each $\frac{1}{2}$ in. thick, and in place of a door stop a $\frac{3}{4}$ in. by $\frac{3}{8}$ in. bead—see enlarged plan at A—is sprigged to the stile of the door to keep it in position when closed. Hinges and lock are similar to those described for the other cupboard.

The fronts of the cupboards could be made of cypress or Oregon pine, the remainder of the woodwork being white pine, and all timber should be wrought or dressed.

The woodwork may be given one coat stain and two coats varnish,

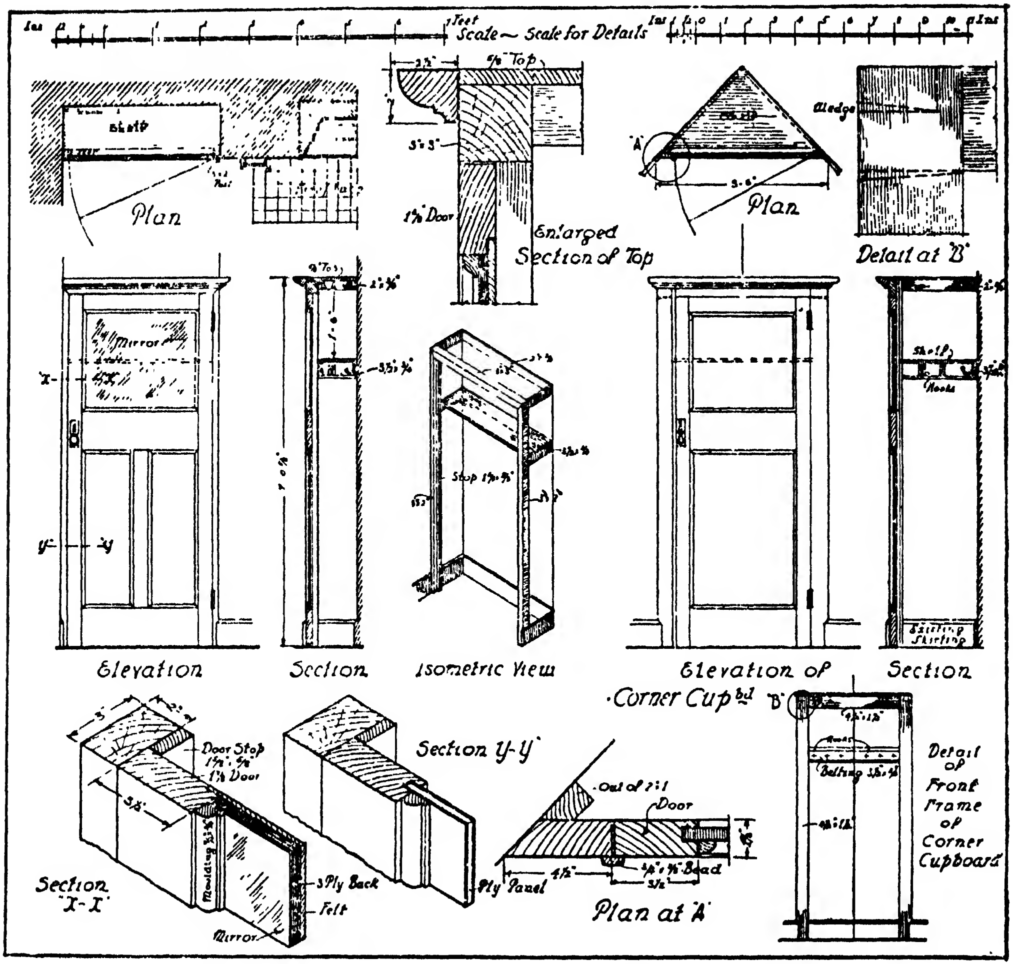


Fig. B.—Constructional Details of Corner and Recessed Cupboards.

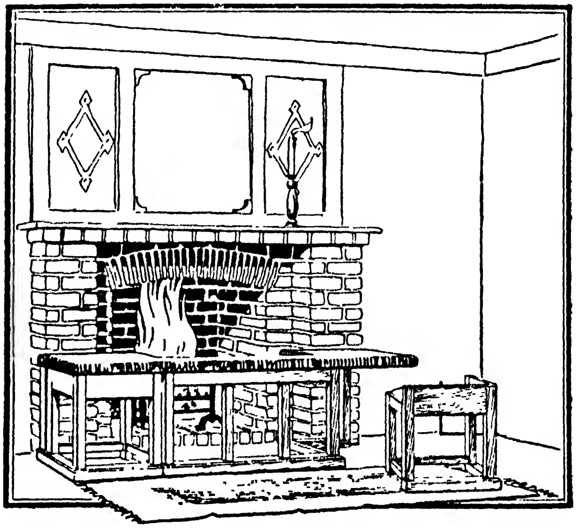
or it may be painted and enamelled to correspond with the other furniture in the room.

CURB SEAT

The curb seat shown on the next page is particularly suitable for the small house in that it embodies two small stool-like seats. When not required for use these are placed under the main top at either end and thus occupy no extra space in the room. In sketch, the seat to the left is shown in this position while the other is drawn out for use. Each of

the small seats has a loose drop-in seat. Oak should preferably be used for the construction, but if deal is used care should be taken to select only well-seasoned stuff.

The main sizes are given in the front elevation and plan in Figs. A and B. The total length will depend upon the size of the fireplace against which it is to stand. The length of the centre portion can be varied to suit this requirement, adding an extra upright if necessary.



The Finished Curb Seat, showing the Separate Corner Seats, detachable for use elsewhere.

The Main Framework.—Fig. C shows the main framework. The lower curb should be made first, from 2 in. by 2 in. squares. The joints are halved together as shown in the small inset sketch. They should be glued and screwed together from the under side. The front edge is bevelled after the components have been fixed together. The eight uprights are of 1½ in. squares. Allowance should be made in their length for the tenons at the bottom by which they are fixed to the curb. The tenons should run right through the latter, being wedged to give additional strength. The top rails are tenoned between the uprights as shown, the mortises being cut to meet inside the uprights so that the maximum length of tenon is possible. The two centre uprights are cut away at the top to take the top rail to which they are screwed from the back. This detail is shown in the lower centre inset sketch in Fig. C. It should be noted that the two outer top rails are cut at both ends in the form of notches. These measure 2 in. by 1 in. and are to allow clearance for the cross-battens underneath the top of seat.

The Centre Seat.—Fig. D shows the seat. The cross-battens are placed sufficiently wide apart to fit into the notches cut in the back rails. As the seat is to be stuffed and covered, it is advisable to remove all sharp edges and corners to prevent the material from being torn. The whole is fixed to the main framework with screws driven upwards through the top rails.

The Side Seats.—One of the seats is shown in Fig. E. It should be noticed that the bottom outer rails take the form of the main curb, so that when the seats are placed under the top the curb appears in an unbroken line round the whole. (See Figs. A and B.) Three of the

legs of each stool are tenoned into the curbing, which is halved together at the corner. The fourth leg is mortised to take the two lighter rails

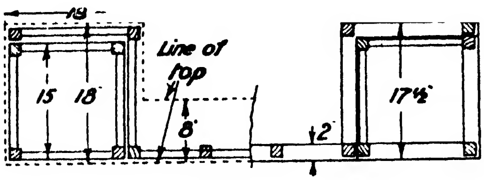


Fig. A.

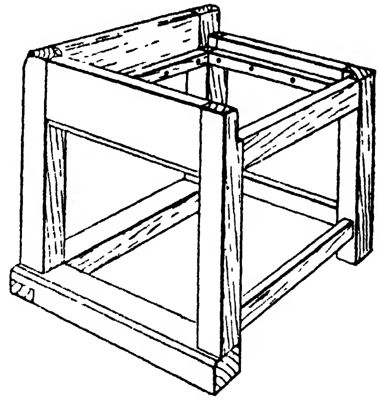


Fig. E.

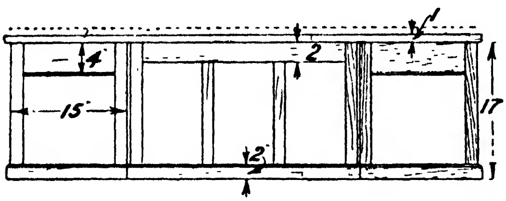


Fig. B.

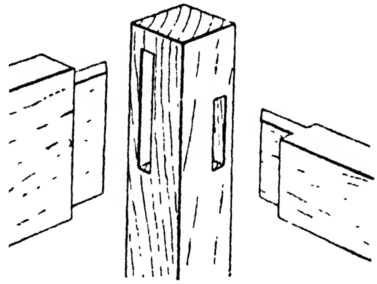


Fig. F.

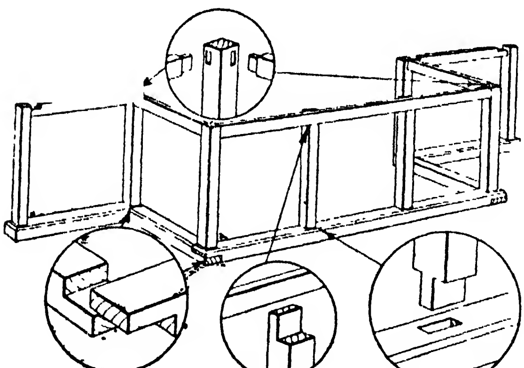


Fig. C.

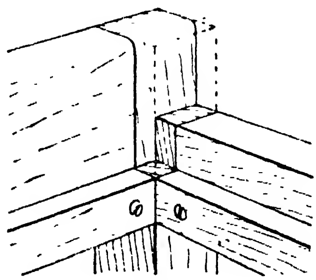


Fig. G.

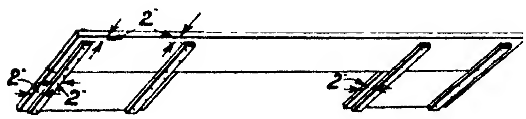


Fig. D.

Constructional Details of Curb Seat.

as shown in Fig. E. All the top rails are tenoned into the legs, the two inner rails being 2 in. narrower so that they will pass under the main top. Fig. F shows how the corner joints are made. They are cut away as in Fig. G, after the whole has been glued together.

The lower curb rails should be glued together before the mortise for the leg is cut. Having done this, glue this corner leg in position. Next glue one of the top rails to this and to an adjacent leg and fix the latter to the curb. The four components of this opposite side are then fixed together and both frameworks allowed to stand until the glue has set. The remaining rails are then glued and the whole allowed to set. When the joints have been cleaned up a series of fillets should be screwed to the top rails as shown in Fig. E. These are to support the loose drop-in seat.

It will be found advisable to round over the inner edges of the wide top rails as in Fig. G. The loose seats consist of simple frames halved together at the corners—2 in. by 1 in. stuff is suitable for this. A clearance of ⅛ in. should be made on all sides to allow for the thickness of the covering material. When making the corner seats the best plan is to take all sizes direct from the main curb so that they fit in position correctly.

The best finish for the whole is to stain it to whatever shade may be desired and then well polish with wax. A good plan is to mix a small quantity of resin with the wax, as this quickens the process.

DINNER LIFT

The lift described and illustrated here will be found very serviceable for passing dishes, etc., from a downstair kitchen to the dining-room above.

The cage would be made, as in Fig. A, to slide in a frame consisting

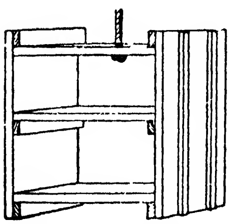


Fig. A.—Wooden Cage for Dinner Lift.

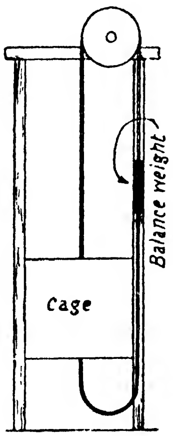


Fig. B.—Simple Lift Scheme.

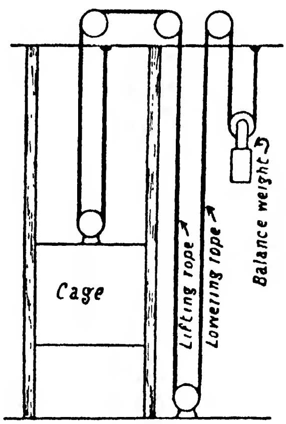


Fig. C.—Alternative Arrangement of Rope and Pulleys.

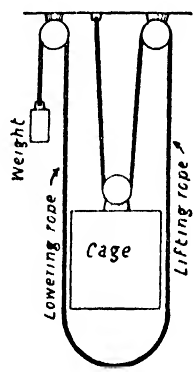


Fig. D.—Another Scheme for the Rope and Pulleys.

of four upright wooden guides, tenoned at top and bottom into horizontal members to keep the guides strictly parallel with each other. V-grooved pulleys for the rope will be wanted, and there are various

ways of arranging these. Perhaps the simplest way is to have a single overhead pulley, as in Fig. B, with an endless rope and balance weight. Another way is an arrangement of small pulleys as in Fig. C. Still another way is shown in Fig. D, each of these being slower than the first but giving more power. Or two lifts may be used side by side connected by a rope passing over a pulley at the top and arranged so that when one cage is at the lower floor the other is at the upper, the cages, of course, counterbalancing each other. When balance weights are used they should be about one-fourth heavier than the empty cage, but not heavy enough to pull it up. A brake is generally used, the weight of the cage bringing it into action automatically when the cage is not rising. For lowering, the brake is kept out of action or controlled by a hand rope. The brake is generally of the band type tightening on the rim of a drum. Alternatively you could buy a self-sustaining pulley block which would prevent movement of the lift when the ropes were not being operated. Or a self-sustaining hand hoist consisting of large rope wheel and barrel could be purchased.

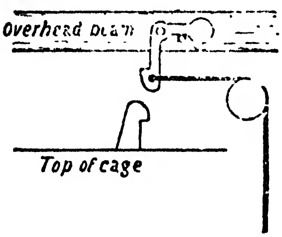


Fig. E.—Automatic Catch at Top of Cage Run.

In the present case it is probable that the lifting and lowering ropes would give sufficient control without a brake. A stop for holding the lift at the upper floor, if you find it necessary, might consist of a catch as in Fig. E, engaging automatically by a spring or by gravity, and pulled out of engagement by a cord. Springs or rubber buffers may be fitted above and below the cage to cushion the limit of its travel.

DOG KENNEL

The making of a kennel for the domestic pet is quite within the abilities of the amateur.

Fig. A shows an ordinary dog kennel, the size of which depends on the size of the dog. A small size may be about 12 in. wide by 16 in. long, by 16 in. high, and a large one may be 24 in. by 36 in. by 36 in. The boarding should preferably be grooved and tongued. If it is not convenient to get matchboard, or grooved and tongued board, the roof should be covered with felt, or have wood strips nailed over the joints.

Construction.—With the exception of the roof, the parts are made separately, as in Fig. B, and nailed together after. The floorboards are nailed on battens at each end, as seen in the figure, and if the kennel is a long one a thinner batten in the middle, as shown, will be desirable. At the ridge of the roof it will be seen there are two $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. strips running the full length, the lower one being fitted diagonally into a notched-out place in the apex of the ends, the upper one, which forms a capping piece, having one of its faces rebated to fit over the top ends

of the roof boards. The front end has an opening cut as shown, and is cleated on the inner face, the same as the back except that the cleat at the base stops at the opening, and, with the latter out of centre as shown, is on the wide side only. The front end also is 4 or 5 in. back from the end of the floor and sides. These parts are nailed together

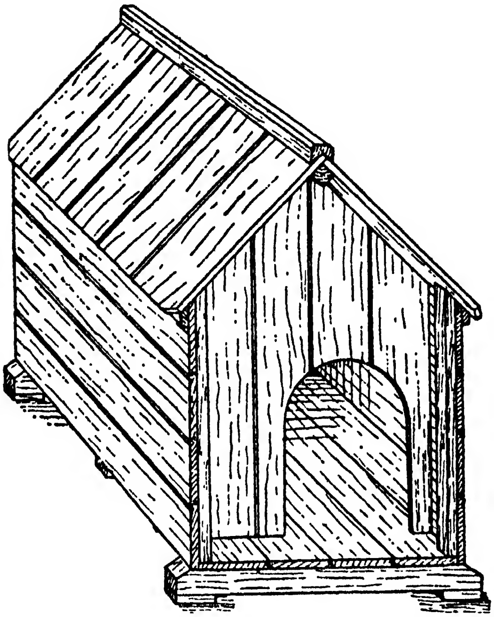


Fig. A.—General View of Dog's Kennel.

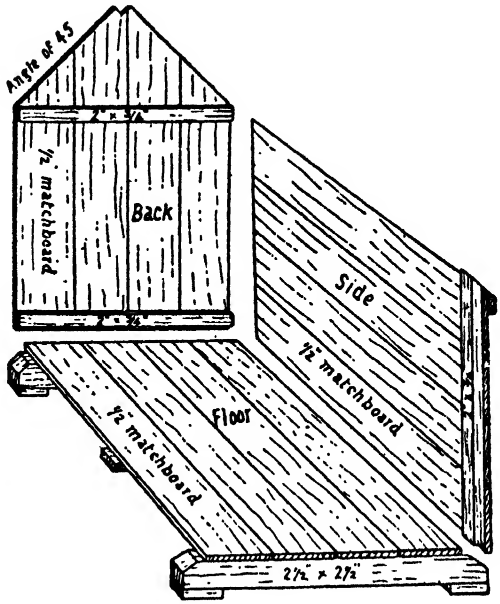


Fig. B.—Floor, Side, and Back, ready for nailing together.

and the roof boards are nailed on one at a time and the capping piece nailed on top, the edges of the roof overhanging an inch or so at ends and eaves.

DRESSING CHEST

A chest of this type has very good accommodation since the whole space is occupied. It is of convenient size for the average small room. Oak is the best wood to use, but for a cheaper job deal stained to resemble oak can be substituted. Fig. B gives the main sizes and Fig. C the construction of the main carcase.

Making the Sides and Back.—Cut out the sides first from ¾ in. stuff, plane the edges square, and test the two pieces to see that they are alike in size. Rebates are cut at both top and bottom edges to hold the top and bottom as shown in Fig. D. Here it will be seen also that mortises are cut near the front edges to hold the drawer rails. All rails and the top and bottom are of ¾ in. stuff. The rails are about 2 in. wide and have

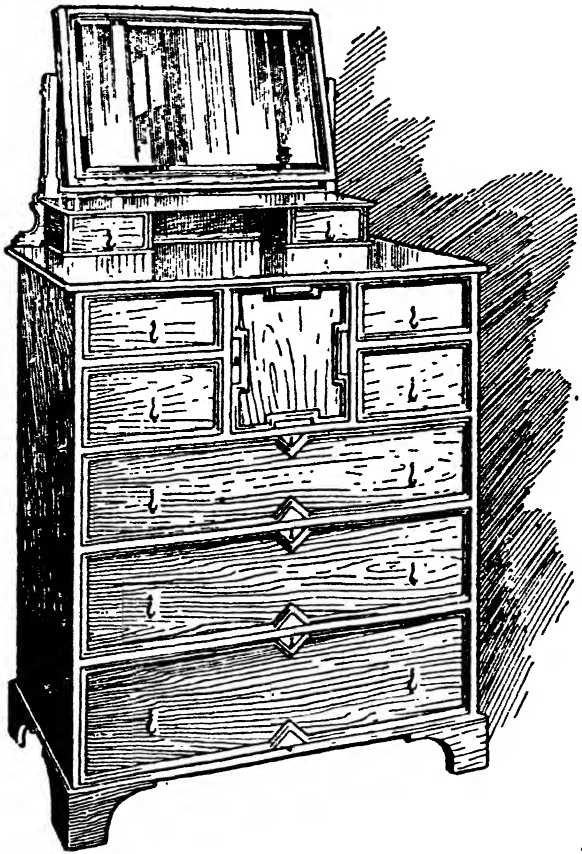


Fig. A.—The Completed Dressing Chest.

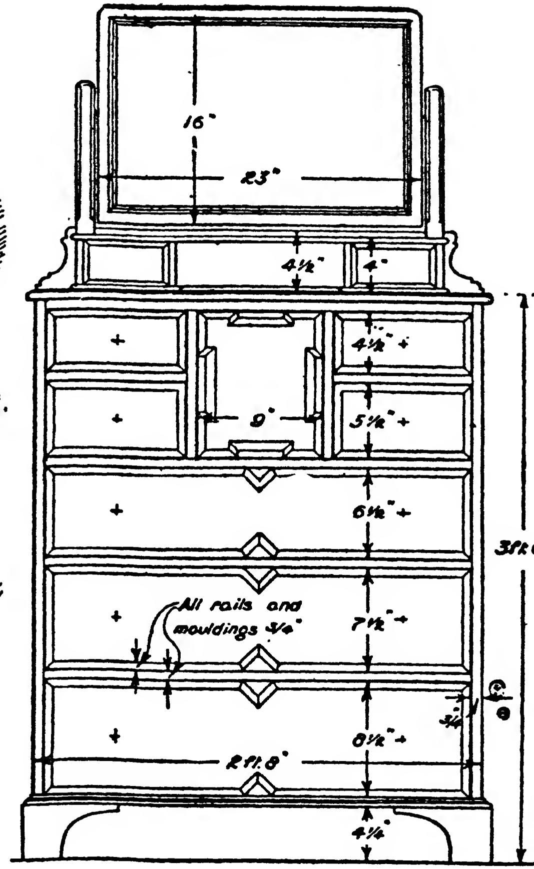


Fig. B.—Front View, showing Dimensions.

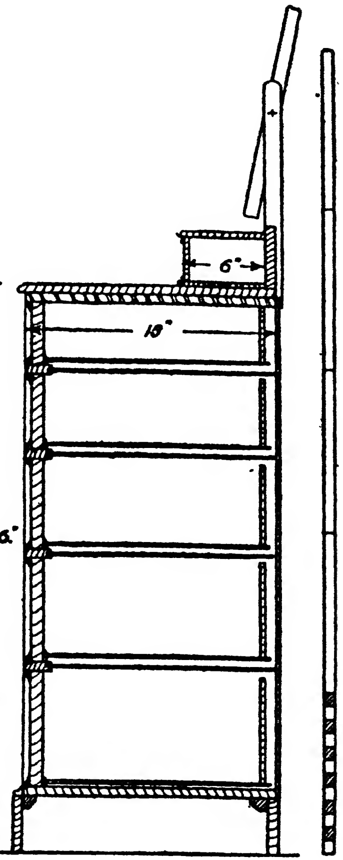


Fig. C.—Side Sectional View.

grooves worked along the back edges to provide a support for the dust-boards, which are about $\frac{3}{16}$ in. thick. Whilst the plough is set to work these grooves, it is advisable to work those on the runners since these must coincide with those on the rails. Solid sides are provided for the small top cupboard; for a good-class job these can be let into grooves worked in the under side of the top, but for an economical piece they can

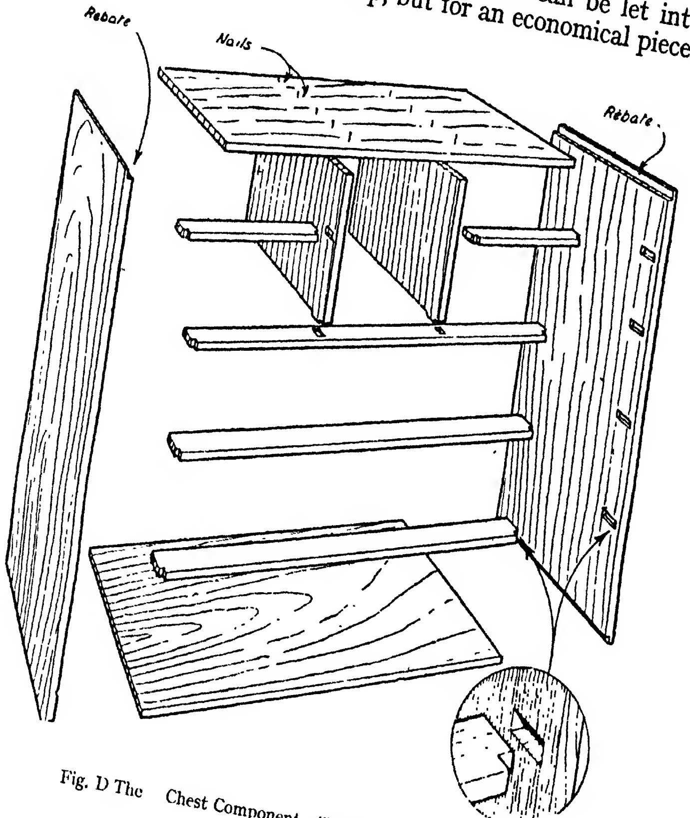


Fig. D The Chest Components, illustrating Construction.

be simply nailed, as in Fig. D. Use glue for all joints, and, where nails are necessary, drive them in askew in alternate directions so that a "dovetail" grip is obtained.

Drawer runners are the same thickness as the rails, and are grooved as already mentioned. They are fixed at the front by means of small stub-tenons cut to rest in the grooves in the rails. At the back they are screwed to the sides. Great care should be taken to space them equally so that the drawers run easily. When the dustboards have been added the back can be fixed; either thin deal or cheap three-ply is suitable.

The Bracket Feet.—Figs. G and H give the details of the bracket feet. The shape can be mapped out from the diagram, in which the squares are ¼ in. long. The corners are mitred and glue blocks are rubbed in the angle to strengthen the joint. Glue and screws are used to fix them.

Constructing the Drawers and Fittings.—Fig. E gives full details for making the drawers. The fronts are rebated at the ends to take the sides, and grooves are cut across the sides to form joints for the back. They should be carefully tested to see that they are square before the glue sets. Be sure to punch in all nails before cleaning up the joints; otherwise the plane iron will suffer badly.

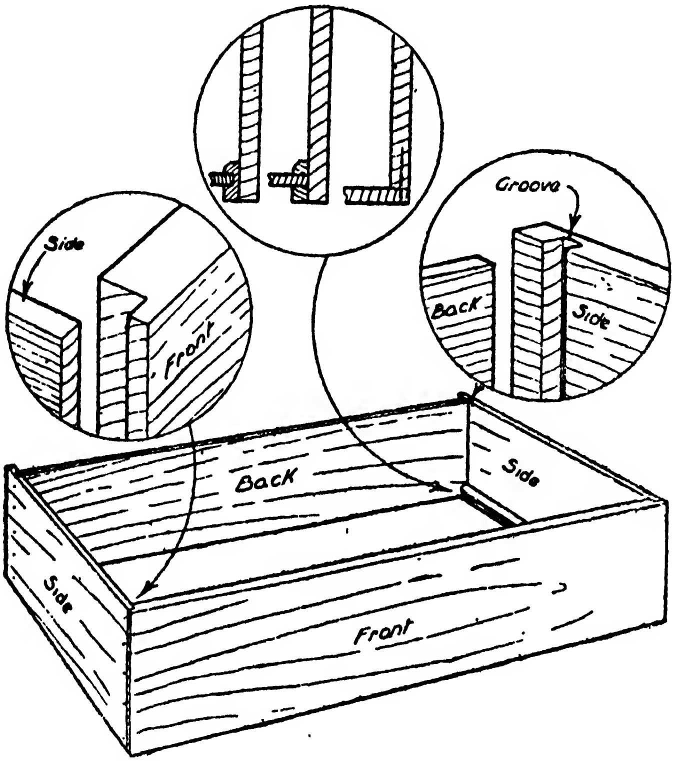


Fig. E.—Constructional Details for making the Drawers.

The small inset sketch in Fig. E shows three alternative methods of fixing the bottoms. That to the left in which grooved slips are glued to the drawer sides is the best. The mouldings are simply glued and nailed to the fronts, the corners being mitred. To form the small pointed projections, small blocks of wood about ¼ in. thick are fixed at the edges and the moulding mitred round these as shown in Fig. F.

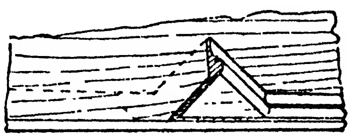


Fig. F.—Moulded Mitre Detail.

Fig. I gives full details for making the trinket-drawer fittings and the mirror supports. The main framework is glued and nailed together, and is fixed to the top with screws. Three dowels are used at both ends of the back rail to hold the uprights and the small shaped brackets are glued and nailed. Note that the supports are cut away at the bottom to fit over the top, and that the upper part is chamfered.

A quite plain square-edged frame is made for the mirror and a small

rebated moulding is fixed to the front edges to form a rebate for the glass (see Fig. J). To fix the glass, lay the frame face downwards on

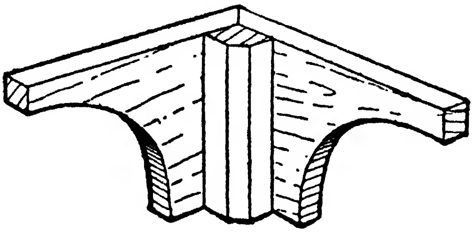


Fig. G.—Detail of Bracket Feet.

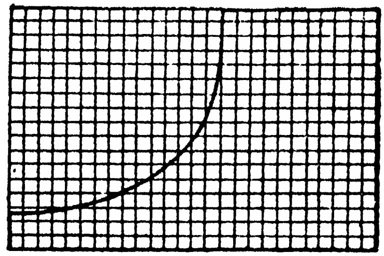


Fig. H.—Method of drawing the Curve of the Bracket Feet.

the bench, insert the glass, and glue small wedges to the rebate at intervals of about 4 in. A three-ply back is then added. Ordinary movements are used to swing the glass; they are fixed half-way up the mirror.

Remove all metalwork before beginning to stain and polish the job.

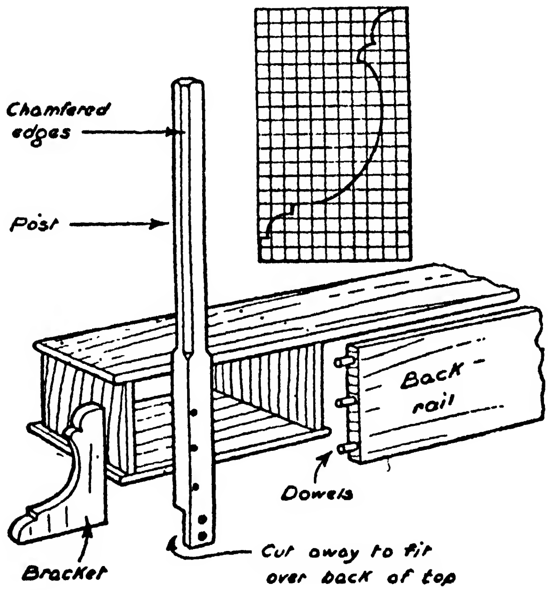


Fig. I.—Trinket-drawer Fittings and Details.

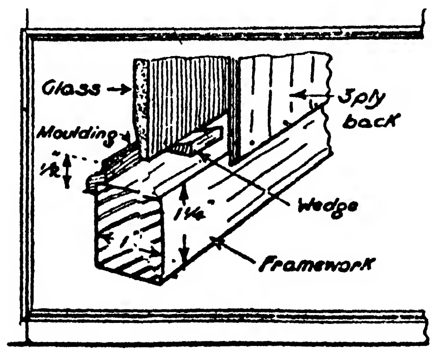


Fig. J.—Method of fixing the Mirror.

FLOOR, OAK, TO LAY

A narrow-pattern oak floor greatly improves the appearance of a ground-floor room or hall and its use enables rugs to be used, instead of large carpets. The oak used for this purpose is supplied in 2 in. widths, by about 1 in. thick, with the abutting edges tongued and grooved.

Whilst an oak floor can be laid over an existing deal floor, it is usual in new houses to lay the floor direct on to the floor joists. The oak used should be quite dry, as, if moist, when laid it will leave slight cracks

when it dries out. The strips should be as long as possible in order to aviod too many joints.

Another important point to remember is to arrange the oak strips in the direction of the longer dimension of the room, so that if the room is used for dancing, the wear is minimised over the edges.

The first strip is laid tightly against the existing skirting or wall and is secured in position by nailing with brass or copper brads of suitable length, as shown in Fig. A. Care must be taken to avoid hitting the grooved edge, a nail punch being used to drive the brad home and clear of the tongue slot. The next strip is then laid and held tightly against the first, using for preference a floor cramp. Do not, however, cramp up any more than is sufficient to make a good joint, since too much cramping pressure will later in the history of the floor cause it to rise in the centre when moist air flows under the joists through the ventilation gratings. This effect is due to expansion of the lower face of the oak, which can only take place by bowing upwards, taking with it the brads.

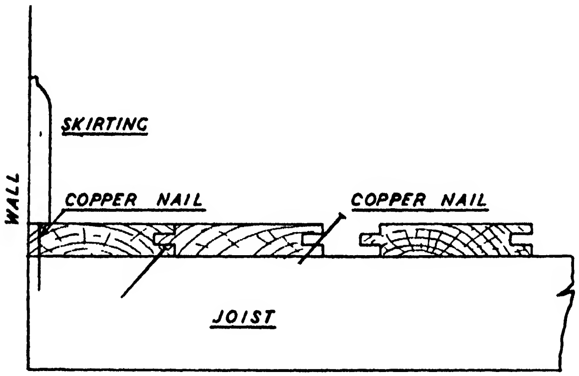


Fig. A.—Illustrating Method of laying an Oak Floor.

If laid on deal flooring the same method of fixing the oak strips can be used, but in some cases where excessive noise or "drumming" is likely to be caused a layer of felt is arranged between the oak and existing floor.

It is advisable to have a beading around the edge as this gives a finish to the floor and hides the end nail holes.

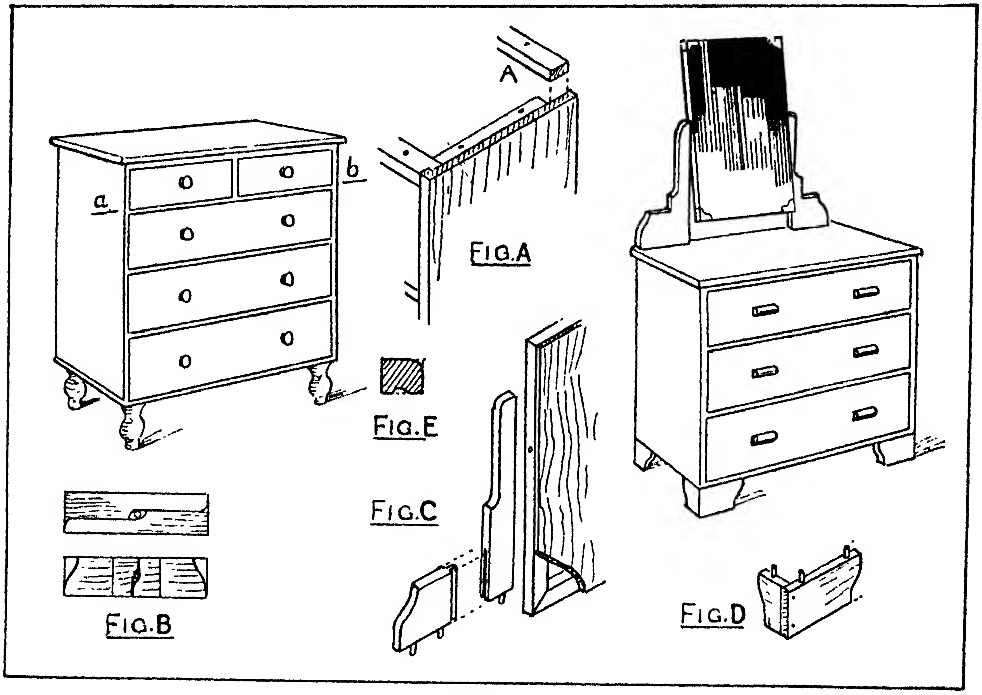
After fitting the floor it is always necessary to plane or hand scrape down the joints until quite smooth. All of the wood should be left with the same surface finish. Finally, give the oak a coat of linseed oil, well rubbed in, and allow this to penetrate for a day or two. Do not tread on the floor during this period, but brown paper or an old drugget can be used if it is necessary to go into the room. If the first coat of oil does not tone the oak sufficiently, give a second one. When dry the floor should be wax polished with a colourless polish of proprietary make. A good deal of physical effort is needed for the first polishing of a new floor, so that if an electric floor polisher can be borrowed or hired this will save much time and energy.

FURNITURE CONVERSION

An old chest of drawers can usefully be quite well altered to make a more welcome bedroom dressing chest and at the same time still preserve in a large measure its capacity for storage.

This example of conversion is illustrated, a modern dressing chest being shown with the original chest of drawers from which it was made. The actual work involved is not much, remarkably little in fact, and could be undertaken by any handyman with the average carpentering knowledge. As these chests of drawers differ somewhat in dimension, no sizes are given in the diagrams, but some suggestions are made.

The drawers should firstly be sawn across on line *a-b*, after the back has been removed. As the drawer runners are likely to be housed in the sides of the chest, they may now be loose after cutting, those affected by the saw-cuts, of course. They should therefore be securely screwed in.



Converting Old Chest of Drawers to Dressing Table.

A nail should also be driven in through the sides into the front rail to secure that. The runners should be cut short about 2 in. to leave space for a back rail, as shown at A in Fig. A. This rail should be narrow enough to leave room for the back of the drawers to enter, the back being afterwards nailed to it. Screw holes should be bored in runners and back and front rails, then the top of the chest, after the odd pieces of sides and rail still attached to it are removed, can be replaced on top and fixed there with screws through the rails and runners.

Replace the back, after cutting it short. Remove the old stump legs as these are not compatible with modern design. Round the edges of the bottom a moulding may be fixed all ready. If this can be

safely removed, take it off; its absence improves the result. The top itself has probably a moulded edge; here again the result looks better if this is planed off to leave a square edge.

The two top drawers will not be wanted in the dressing chest, so from these (the fronts only) the back supports of the glass can be got. Fig. B shows how these can be cut from the wood. Shape them up and join together in pairs with a tongued and grooved or shallow mortise and tenon joint. They are now fixed to the top of the chest with dowels, a distance apart to suit the glass, as in Fig. C.

As regards the glass, this should preferably be of the frameless variety, but if not available it may be necessary either to utilise an existing glass or, if one cannot be spared, make up a frame about 1 ft. 6 in. wide, by 2 ft. long, and leave the glass until one can be bought. In the meantime, a small mirror can doubtless be used to serve the purpose, mounted on the frame, pro tem. The frame, by the way, is made up of ¾ in. by 1 in. wood, or thereabouts, covered with a thin wood panel (see Fig. C). Quite likely the wood of the sides and back of the unwanted drawers could be utilised to make the panel. Fix the frame with swing glass fittings.

The feet, Fig. D, are made up of pieces of wood nailed and glued together at right angles, the long ones about 6 in. and the short ones 3 in. They should be high enough to raise the chest to a convenient height for a dressing chest. After cutting the two end pieces of the glass supports from one drawer front, enough wood may be left to cut two of the short foot pieces, as in Fig. B. The remainder must be cut from any suitable thickness of spare wood available. Fix the feet in place with a dowel joint.

The work should now be cleaned up and glass-papered. Remove the knobs from the drawers as these will be replaced with modern-shape pulls. If the chest of drawers was of solid hard wood the resulting dressing chest could be repolished, after staining as may be necessary those parts of new or cut wood to match the remainder. A painted chest could after cleaning be white enamelled, or treated with any colour art enamel preferred.

For the handle pulls, plane a 2 ft. length of ¾ in. by 1 in. wood to the section, Fig. E, cut into 6 pieces, and fix to the drawers with glue and screws from the inside. These could be treated to match the woodwork, or stained ebony and varnished to make a pleasing contrast.

GRAMOPHONE RECORD CABINET

The cabinet described here will enable the gramophone user to store records with convenience and in safety.

The wood required is 1¼ in. thick, the dimensions of the box to take 10 in. records being: length 37½ in., breadth 12 in., and depth 11 in. (including the recess in the lid).

The records are stored in an upright position, supported and separated by partitions of 1/16 in. millboard. The length given above will accommodate

about 100 records, but the cabinet can be made longer or shorter according to the capacity needed. The partitions should be exactly $11\frac{15}{16}$ in. by 4 in., and any printing works will supply these cut exactly to size. The partitions rest upon battens 3 in. by $\frac{1}{2}$ in. by $37\frac{1}{2}$ in. screwed to the bottom of the inside of the box in a lengthwise position as shown. The record therefore protrudes about 3 in. above and below its partition. Before installing the partitions, a thick piece of felt or baize must be tacked down the centre of the bottom of the box at the point where the records will rest when in position, this being to enable the record to be dropped into the space allotted for it without breaking.

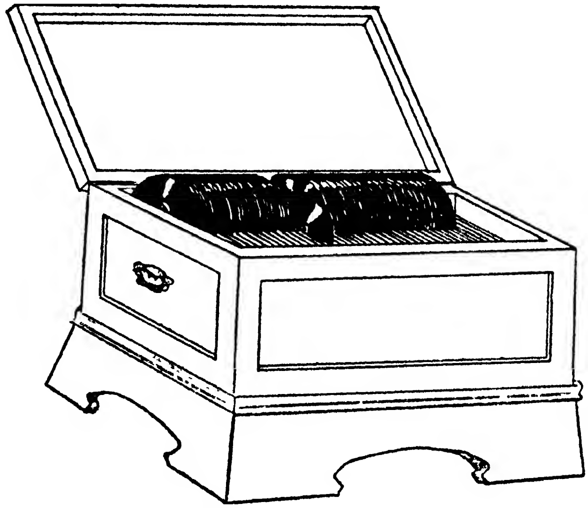


Fig. A.—The Completed Record Cabinet.

The partitions are spaced by strips of $\frac{3}{16}$ in. millboard, one at each end. To fit the partitions into the box, set the box in a perpendicular position on its end, and carefully lay the partitions and strips in position upon

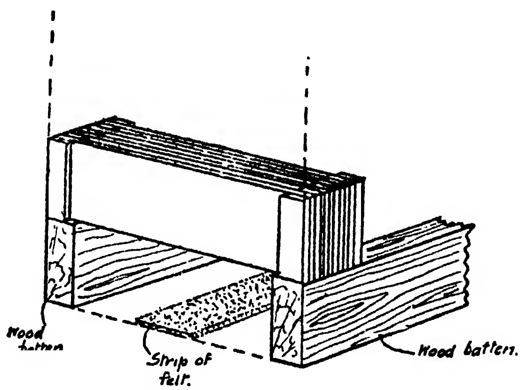


Fig. B.—Showing how the Partitions are made.

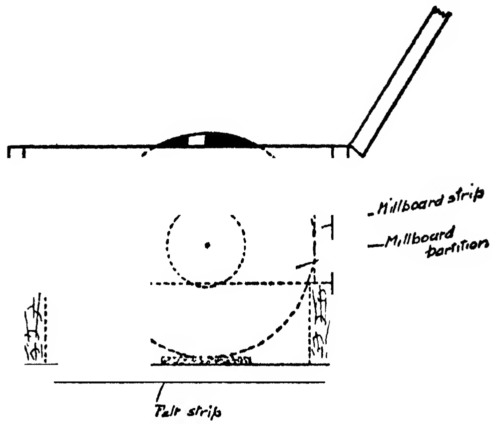


Fig. C.—Side View of Record Cabinet.

each other. The partitions should be an easy fit across the box, being $\frac{1}{16}$ in. less than the total width, and when the last strips are wedged tightly in, and if the placing is carefully done, no adhesive will be found necessary between the boards. Care must be taken to see that the boards are all perfectly flat before inserting.

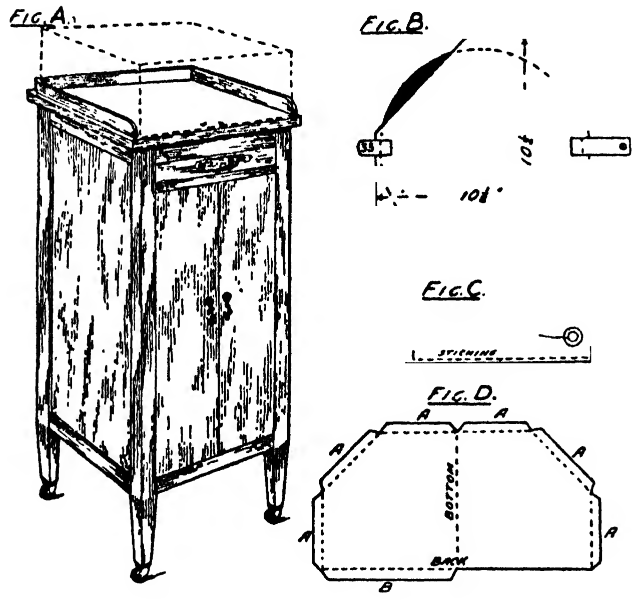
The aperture of $\frac{1}{16}$ in. will be found to house the record quite comfortably. To use the cabinet, the record needed is rolled forward with the tip of the finger to the front of the box, when it will protrude about 2 in. and can be easily withdrawn. In replacing the record, it can quite safely be dropped into its space, the felt on which it rests preventing breakage. The spaces are numbered on a piece of white card glued to the top of the millboards at the back edge, and an index of records is attached to the inside of the lid.

It will be found convenient to raise the box on a fairly deep stand. This stand can be of any suitable design so long as it is strong enough to carry the very considerable weight of the box of records.

GRAMOPHONE STAND, FOR PORTABLE TYPE

The design of cabinet illustrated here is recommended for the portable type of gramophone.

As users of portables not often own records exceeding the 10 in. size, the storage spaces may be made 11 in. high. This, with other details as indicated in the illustration, Fig. A, would string the top of the band to about 35 in. from the floor, a convenient height for working the gramophone.



Cabinet for Portable Gramophone.

The width and depth of the cabinet would be determined by the dimensions of the instrument. As a space of 16 in. wide is sufficient to accommodate 100 records in their containers, it will be seen that a cabinet of the dimensions indicated would take from 150 to 200 records.

The construction of the cabinet is obvious from the illustration.

A shallow drawer may be fitted at the top for the storage of needles and other accessories. This might be 2 in. deep inside, sufficient to take a spare sound-box. The corner uprights could be $1\frac{1}{2}$ in. square and the panels of three-ply.

Containers.—The containers should be made from stout Manila paper. Fig. B shows one complete container, which is open at top and front. The

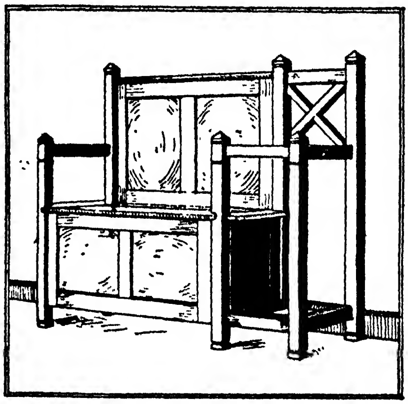
cut-off corner enables the record to be gripped when the container has been drawn forward in advance of the others. The tabs in front carry consecutive numbers. The tabs at back of linen tape, ¾ in. wide, are to limit the forward movement. Fig. C shows one of these tabs to large scale, from which it will be seen that the tape is folded and stitched in the manner illustrated and provided with an eyelet. The loose ends are attached with an adhesive on each side of the container.

The whole block of containers in each compartment of the cabinet is secured in place with a brass rod passed through the side panels and each of the eyelets. The simplest way to thread the tabs on the rod is to first pass a long cord through them, then to pass the end of the cord through the holes in the panels from inside; next, to insert the block of containers in its compartment, and finally draw through the brass rod by means of the cord, an eye having been drilled in its end for the purpose.

Fig. D shows how to cut the containers, to provide overlaps A for strengthening the edges, and an overlap B for closing the back. Thin glue is the best adhesive to use.

HALL SEAT, LOCKER, AND UMBRELLA STAND

A useful piece of space-saving furniture for the small hall is the combined seat, locker, and umbrella stand, a design and description of which are furnished below. The fitting occupies very small space, and besides its usefulness, provides quite a handsome and attractive bit of furnishing for the hall.



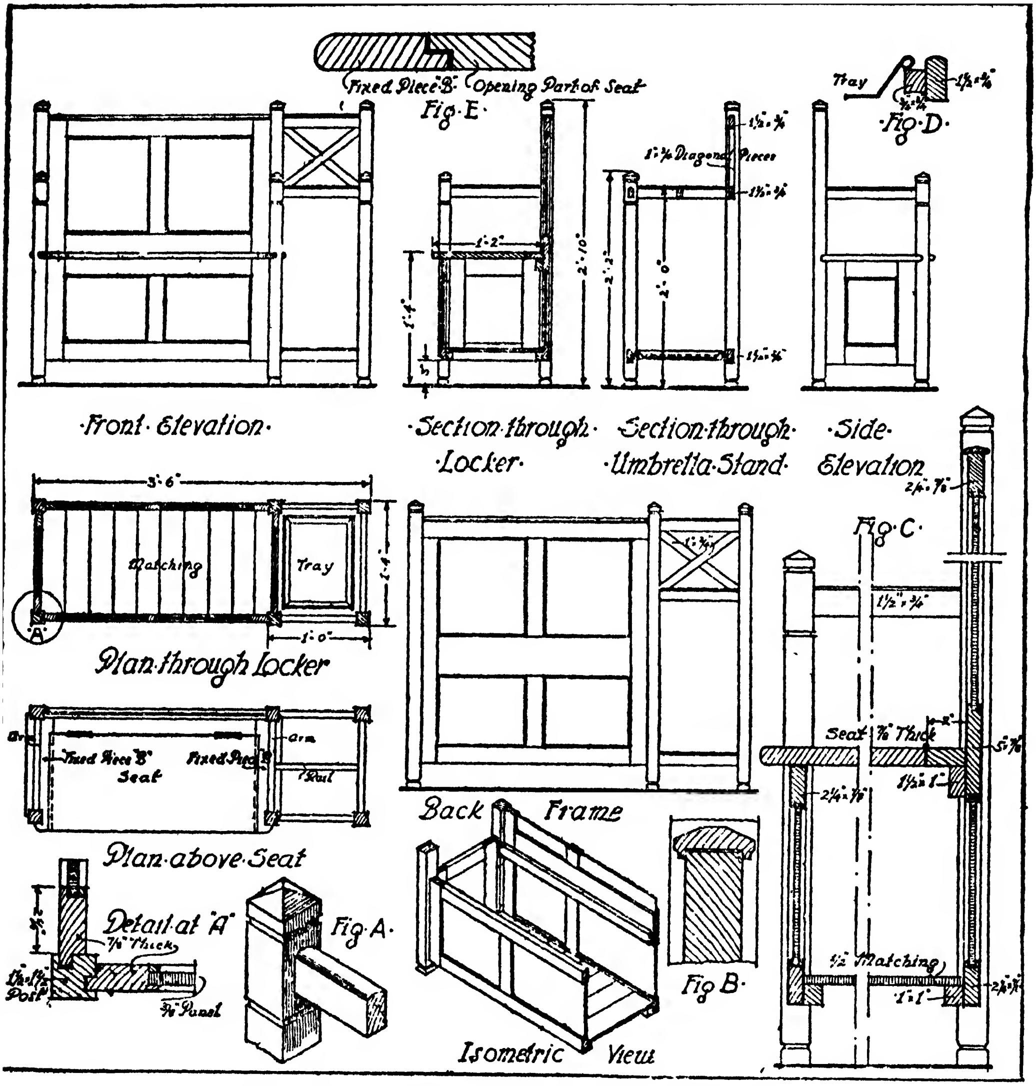
The Completed Hall Fitment.

With regard to the construction, the six posts are cut to the lengths and moulded at the top and bottom, as shown on the elevations and sections. Raggles or grooves are cut into the sides of the posts at the four corners of the seat and locker, of a size to take the tongues of the frames of the ⅞ in. thick panelling which forms the sides of the locker and the back of the seat. The method of fitting the panelling into the posts is shown in the enlarged "Detail at A." Mortises are also in the posts, into which are tenoned the arms of the seat and the bottom and top rails of the umbrella stand. These rails are 1½ in. deep by ¾ in. thick, and are rounded on the top edge.

The frames of the panelling forming the front and sides of the locker, and also the back of the fitment, are ⅞ in. thick, and have the edges forming the panels slightly rounded. The panels are ⅜ in. thick, fitted into the framing and fixed with a light moulding at the back. The stiles and rails of the framing all show 2¼ in. broad with the exception of the middle rail of the back, which is 5 in. broad. The top rail of the panelling at the

back is finished with a small cope $1\frac{3}{8}$ in. broad by $\frac{5}{8}$ in. thick, as illustrated in Fig. B.

Locker Floor.—To form the floor of the locker, 1 in. by 1 in. fillets are screwed to the sides of the lower rail of the front and back panelling,



Constructional Details of the Combination Hall Fitment.

and to these fillets are nailed short lengths of matching, $\frac{1}{2}$ in. thick. These fillets are depicted in position in Fig. C, and also in the isometric view.

The Seat.—The seat is $\frac{7}{8}$ in. thick, with the opening part hinged to a fixed piece at the back, which rests on a $1\frac{1}{4}$ in. by 1 in. fillet screwed

to the mid rail of the back panel framing, whilst this fixed piece is also tenoned or half-checked into the fixed side pieces, the latter being screwed to the framing of the locker and cut to fit round the front and back posts, whilst they are also projected beyond the face of the framing at the sides and front, as shown in the drawing, "Plan above Seat."

These fixed side pieces are $3\frac{1}{2}$ in. broad by $\frac{7}{8}$ in. thick, and are half-checked along their inner edge to provide a rest for the opening part of the seat, which has also its edges half-checked to fit into the rabbet in the side pieces. A detail of this part of the construction is given at Fig. E. The front and ends of the seat are rounded on the edges, and the opening part is hinged to the back piece by means of 3 in. brass hinges.

The Umbrella Stand.—As already mentioned, the umbrella stand is formed by means of rails tenoned into the posts (see Fig. A), but at the back a feature is made of a small panel formed by inserting two diagonal pieces each 1 in. broad by $\frac{3}{4}$ in. thick, preferably mortised or tenoned into the posts and rails, or, alternatively, nailed to same. These diagonals are shown in the elevation of the back frame. To carry the metal tray for the umbrellas, fillets $\frac{3}{4}$ in. by $\frac{3}{4}$ in. are screwed to the bottom rails of the stand, as shown at Fig. D.

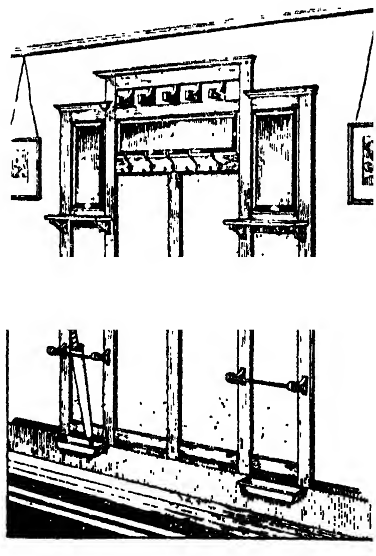
The fitting would look well if made in oak; but for cheapness, cypress or Oregon pine, stained and french polished, could be employed.

HALL STAND

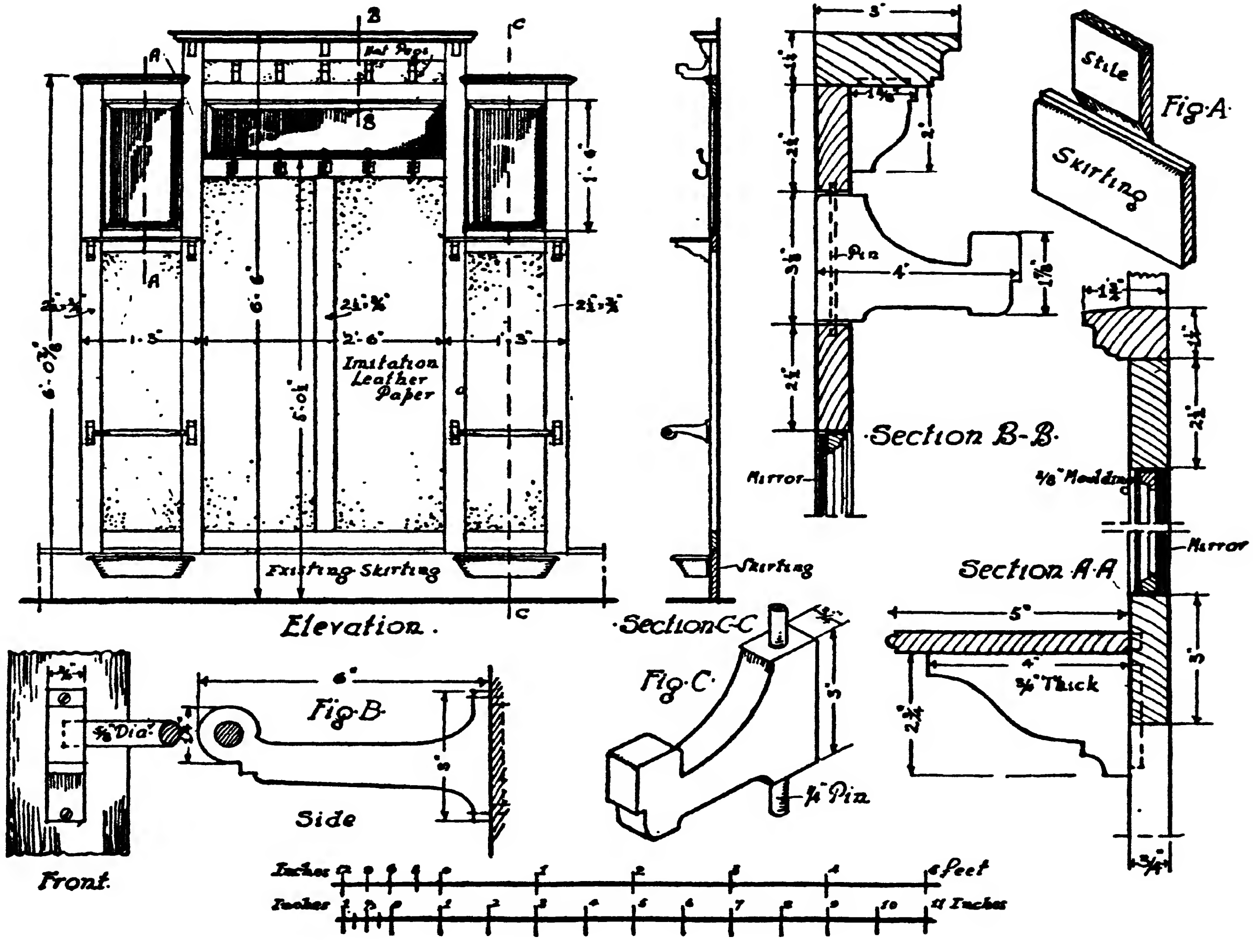
In the majority of houses erected nowadays, owing to cost, the area of the hall or lobby is generally reduced to the minimum, and more especially is this the case in the thousands of houses which have been built under Government Housing Schemes or with the assistance of the subsidy.

The furnishing of the small hall, therefore, becomes somewhat of a problem, as, by providing a hall stand of the ordinary type, more room is taken up than the householder can afford, with the result that the coats and hats are simply allowed to hang on hooks fixed to the wall.

By the adoption of the space-saving hat and coat rack described below, which, by the way, only projects 6 in. from the wall, valuable space is saved and an article of furniture is provided which will serve as well as any hall stand. The rack also possesses this further advantage, that the umbrellas and sticks are not covered up by the coats and the former can be inserted and withdrawn freely, which is a distinct improvement on the ordinary type of stand.



The Finished Hall Stand.



Constructional Details and Dimensions of Hall Stand.

Constructing the Framework.—With regard to the construction, the framing for the rack should first of all be made and laid out beforehand and then fitted into position on the wall.

The stiles, or upright pieces, and rails are all $2\frac{1}{2}$ in. broad by $\frac{3}{4}$ in. thick, with the exception of the short rails under the side mirrors, which are 3 in. broad by $\frac{3}{4}$ in. thick. A moulding screwed to the top of the framing and supported on three small brackets is used as a finish to the high portion of the fitting, whilst a smaller moulding nailed through the top of same to the framing forms a finish over the top rails of the side mirrors.

The hat pegs are of wood and are pivoted between the two top rails of the centre portion by means of $\frac{1}{4}$ in. pins, so that they can be folded flat against the wall if desired. The arrangement is clearly shown in Section "B-B" and Fig. C.

The Mirrors and Fittings.—After the framing is fixed to the wall, the mirrors are inserted and held in position by means of $\frac{3}{8}$ in. by $\frac{3}{8}$ in. mouldings as shown in the enlarged sections.

For holding brushes, etc., two small shelves are provided; these are each supported on moulded brackets, which, with the shelves, are housed and screwed into the stiles and rails respectively (see Section "A-A").

The brackets forming the ends of the umbrella stands are 6 in. long by $\frac{3}{4}$ in. thick, housed and screwed into the stiles; let into the former are $\frac{5}{8}$ in. diameter wood or metal rods, which form the front of the stands. A sketch of the bracket is shown in Fig. B.

The trays are of the variety usually found attached to the ends of church pews and are simply hung from screws to the skirting.

Metal coat hooks are provided and screwed to the rail under the centre mirror.

Protecting the Wall.—To avoid destroying the wall with coats hanging against it, it will be necessary to paper the space occupied by the rack with wall-paper which can occasionally be washed down, or which is of a nature that will stand hard usage. There are several varieties of such papers on the market, but an imitation leather paper is suggested as being as suitable as any for forming the panels.

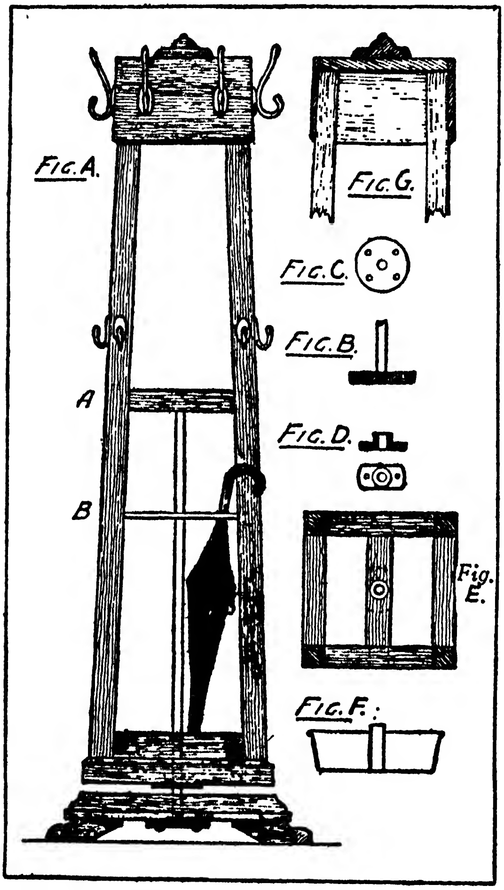
To fix the paper, the simplest way is to paste the former to the wall within the space from the top of the skirting to the centre of the outside stiles and top rails of the fitting; this method saves cutting and also prevents the wall showing, which would be the case if the paper was cut and fitted into the panels, and any shrinkage taking place in the timber framework.

Fixing Framework to Wall.—The framing is fixed to the plaster walls by means of Rawlplugs, the various pieces being plugged separately and butt jointed. In fixing the upright pieces to the skirting the latter can be cut and the stiles mitred to the top members of same, but an alternative method is shown in Fig. A, where by levelling the stiles any cutting of the skirting is avoided.

The fitting is of Oregon pine or cypress and can be painted, stained and varnished, or stained and french polished.

HALL STAND, SUITABLE FOR FLAT OR SMALL HOUSE

The hall stand illustrated should prove useful where hall space is limited, and particularly where there is a recess of insufficient width to accommodate one of the usual pattern. It embodies an umbrella stand, and the whole may be revolved upon the central pivot, so that coats and hats may be hung on all its four sides. Made in hard wood, its appearance would be quite presentable though not following conventional lines. The height might be 5 ft. 6 in. to 6 ft., from which the other dimensions may be deduced with sufficient accuracy from the drawing, Fig. A, which shows the stand in elevation. The uprights should not be less than 2 in. square.



A Hall Stand for a Small House.

To ensure stability, feet should be fixed at each corner of the base as shown. The base itself should be cut from the solid. The pivot on which the superstructure rotates should be a solid metal rod, preferably brass, as wet umbrellas and coats would be constantly in contact with it, or, if of steel, it should be nickel-plated. It should be screwed securely into a stout flange, as shown in Fig. B. A circular plate, Fig. C, should be fixed to the bottom of the stand, bored an easy fit for the rod. The top of the rod should be reduced in diameter to form a shoulder, and a flanged bushing, Fig. D, should be provided and screwed to the cross-piece shown in Fig. E, which is a cross-section at the point A, Fig. A.

Fig. F shows a tray of stout zinc sheet with rolled edge and central tube, the latter an easy fit on the pivot. It might be coated with one of the recently introduced black stove enamels that will stand a considerable amount of wear and do not flake off.

Fig. G shows the head of the stand in section, the closed-in top being furnished with a turned finial as an ornamental finish. At the point B, Fig. A, brass rods should be fixed across between the uprights to support the sticks and umbrellas.

Framing Up.—The method of framing up the stand will be obvious to the mechanic who has graduated in simple cabinet work.

Made in mahogany, this stand might be furnished with aluminium hooks, obtainable at most ironmongers', in which case the brass pivot and cross-rods should be of white metal to match. If of oak, lacquered brass for all metal parts would look best.

INLAYING OF WOOD, IMITATION

This is a hobby that can be recommended to readers as being simple and interesting. All the materials necessary are some small hair brushes, a sharp pointed tool for designing, a little polish, some wood stains, and a supply of wood. Spirit aniline stains such as those sold in hardware shops should be used, while the wood should be close grained and light in colour, such as three-ply birch.

First cut the wood to the shape required and clean the surface. Next scratch your design on with the sharp-pointed tool; alternatively stencils or other guides may be used, or a bold design drawn freehand. The surface of the wood should now be cut along the pattern just sufficiently to prevent the stain from over-running.

The cut design being complete, the next thing is to apply the colours. Before doing so it is as well to test these colours on a scrap of wood of the same texture as the work. It should be remembered that the usual shades of mahogany, Jacobean oak, ebony, and golden oak can by dilution, concentration, or careful intermixing produce a wide range of shades. No particular skill is required in applying the stain, except that care is required to prevent the stain from running. This is liable to take place where the wood is soft or spongy. To prevent this, mix just sufficient polish with the stain to give it body.

When the staining is completed, give the work a light coat of polish with the hair brush: the process should be repeated until the polish stops sinking, when a good rubber of polish will fill in the cuts.

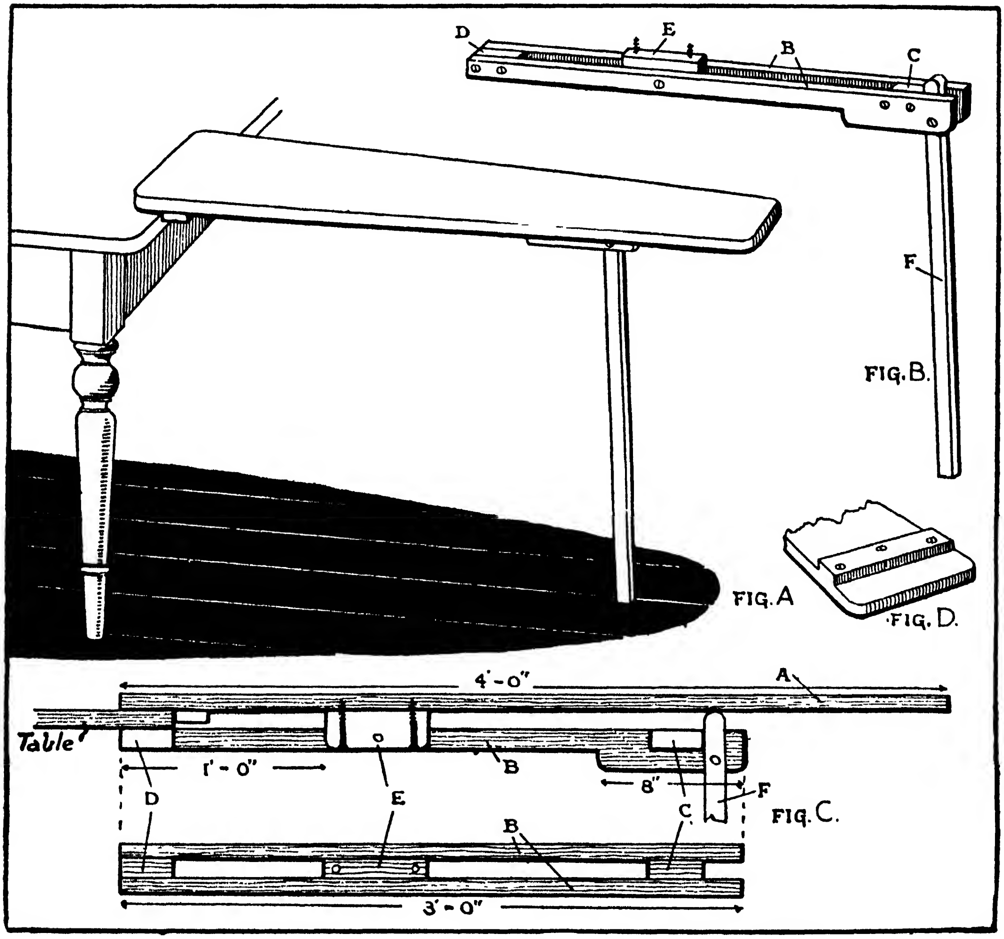
IRONING BOARD

The ironing board shown in Fig. A may be folded flat into a small space, or fixed in a moment to any table. The board may be made of a size to suit individual needs, and it is attached to the table by means of two spaced levers which are pivoted to a block fixed under the board. A folding leg is fitted at the back ends of the levers, and when this leg is opened out its projecting top end presses against the board and causes the front ends of the levers to clip the table top.

Construction.—The board A should be cut from a sound piece of pine 1 in. thick, and should be about 4 ft. long by 14 in. wide at the front, tapering to 10 in. at the back. The edges could be rounded, and the upper surface covered with suitable stuff tacked around the edges.

The levers, pivot block, and leg should all be of 1 in. hardwood; they are shown separately in Fig. B, and details are shown in Fig. C. The

levers B are 3 ft. long by 1 in. wide at the front end, swelling out to 2 in. at the back, as shown in Fig. C. They are spaced by two blocks C and D, which are 3 in. long by 1 in. square. The back block C is fixed $2\frac{1}{2}$ in. in from the back ends of the levers, but the front block is fixed level with the front ends. The pivot block E is 6 in. long by 2 in. wide; it is pivoted between the levers by means of a screw driven



A Folding Ironing Board.

through one lever into the other, and it is screwed under the board so that the front ends of the levers are level with the front of the board.

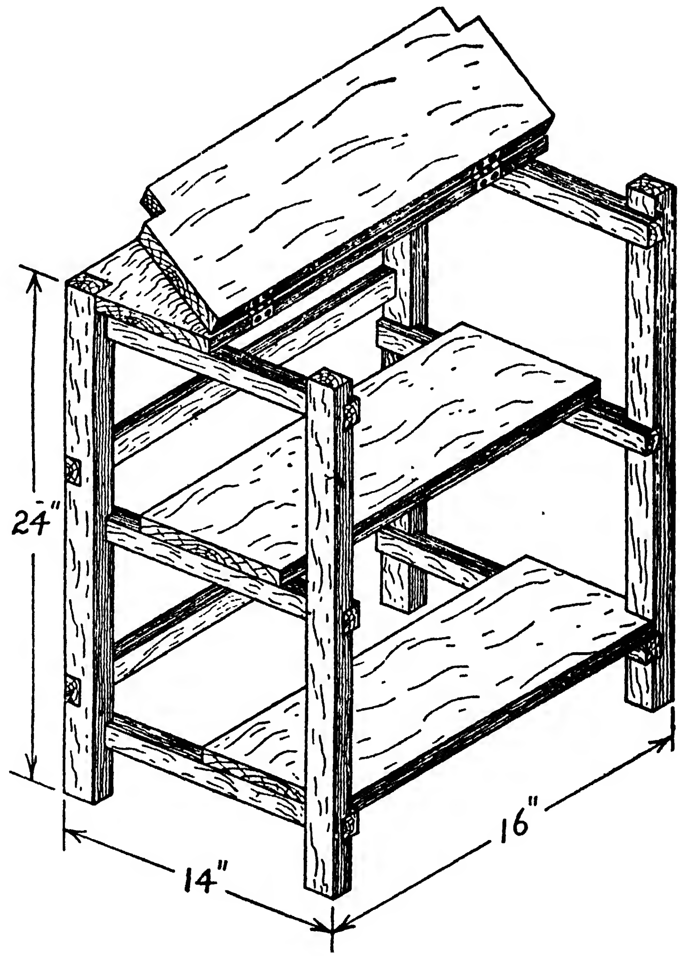
The leg F is 1 in. square, with its length arranged to suit the table to which the board is to be fitted. It is fitted between the levers and fixed with a screw driven through one lever into the other in such a position that when it is opened the back spacing block will act as a stop for it when it reaches just a little beyond the perpendicular, while the pro-

jection above the levers must be sufficient to cause their front ends to firmly clip the table.

A batten about 2 in. wide may be screwed across the front end of the board, as shown in Fig. D, to rest against the edge of the table, and to strengthen the board, but care must be taken to see that it is not too thick or it may interfere with the working of the levers.

KITCHEN STEPS AND STOOL

The illustration on this page shows a useful article for the kitchen, which serves the purpose of a stool or steps for reaching things from shelves. The whole of the framework is constructed of 2 in. by 2 in. wood batten, and the two back struts may be of 2 in. by 1 in. batten. The steps are of $\frac{3}{4}$ in. board, and are fixed in position as clearly indicated. The top step is provided with a hinged piece, which may be turned down when the article is required as a stool. The overall measurements given may be varied at will in the case of more steps being required. Before fixing the two back struts, care should be taken to get the frame and steps well squared up, and it is better to use screws for fixing.



Combined Kitchen Steps and Stool.

A coat of stain will add to the finish, and if desired the whole of the top may be covered with green baize.

KITCHEN TABLE

The folding wall table shown in Fig. A is recommended as being a most useful addition to the kitchen furniture. Being easy to make it calls for no special skill in carpentry. When not required it can be dropped in an

instant and folded flat against the wall (Fig. B). The table should be made of $\frac{3}{4}$ in. wood to the width shown. In addition to the glued joints the end pieces AA should be attached to the table ends underneath by means of screws. These end pieces are secured flush with the table ends so as to clear the wall board C as shown in Fig. C. The legs are planed to $\frac{5}{8}$ in. by 2 in. and cut to the length shown. They are hinged to the table so as to clear each other when folded (see Fig. C), which shows the under side of the table with the legs and wall board hinged in position. It will be noticed that the latter is shorter than the table to allow the end pieces on the table to clear it as shown in Fig. C, C. Before fitting the board to the wall bore

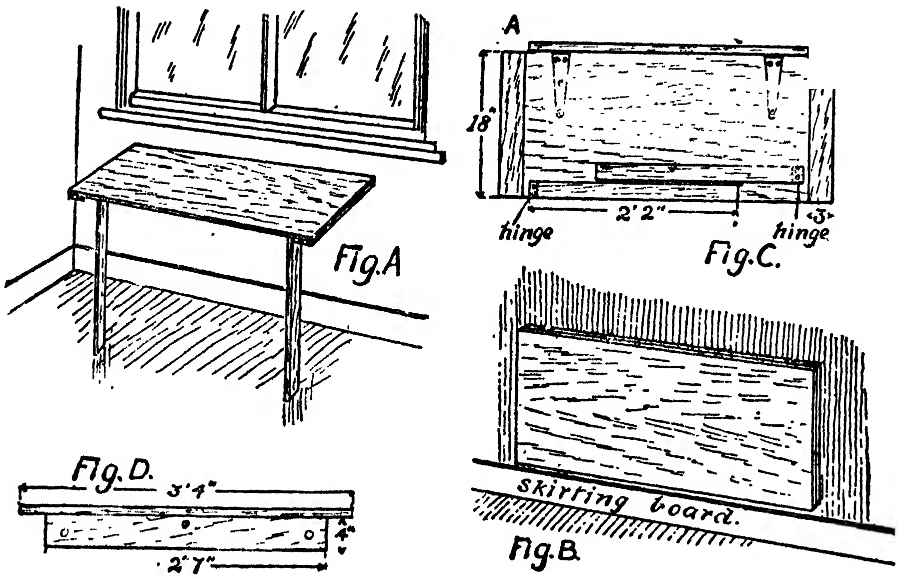


Fig. A.—Table Ready for Use.
Fig. B.—Table Folded against Wall.
Fig. C.—Back View showing Position of Legs.
Fig. D.—Holes in Wall Board.

A Neat Wall Table for the Kitchen.

three $\frac{1}{4}$ in. holes through as shown in Fig. D. To fit the table to the wall, hold the wall board parallel to the floor in the position selected and drop the legs. Adjust the table until it is level and mark the holes on the wall through the holes in the wall board. At these points drill a hole to take a $\frac{3}{4}$ in. diameter plug. Secure the wall board to these plugs by means of three 2 in. screws.

KITCHEN TABLE AND SEATS, FOLDING

The efficiency-fitting in the home is the natural outcome of the wishes of some people to live in a house in which every room does a double duty. In this way every room does a double or triple service.

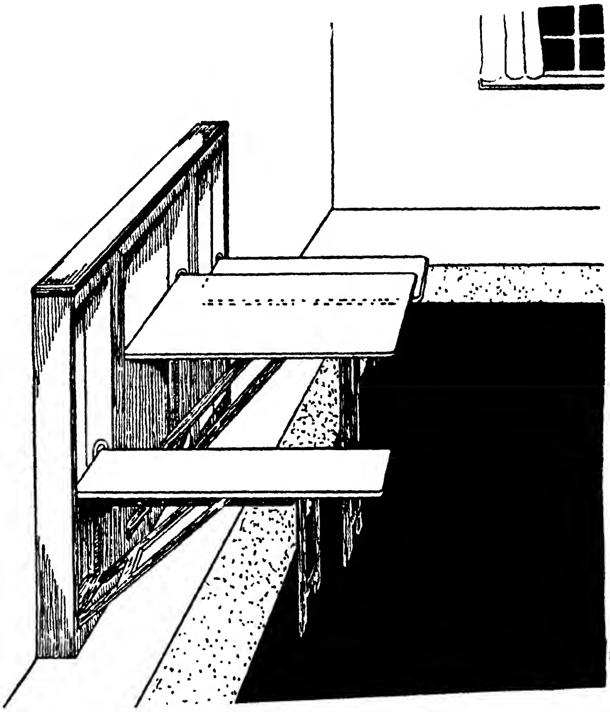
It is the folding or concealed table which has made it possible for the

apartment user to convert the living-room, which may be used as the den, sewing-room, or play-room, into the dining-room. It is the folding or portable bed that enables him to transform the same room into a place for sleeping.

The illustration shows a simple, but most useful, folding table and seat idea.

The folding table and seats that are shown were originally designed for the kitchen. However, there is no reason why a folding table should not be built into the walls of the living-room of the smallest type of apartments.

To build the table and seats for an old house, a frame would require to be made which would be a recess for the table to fold into. The outer leg of the seat and table would be hinged so that it would fall flat against the under side of the top. The wall end which travels in a groove on each side of the top then slides down towards the bottom, allowing the seat and table to fold up flat.



Folding Kitchen Table, with Seats.

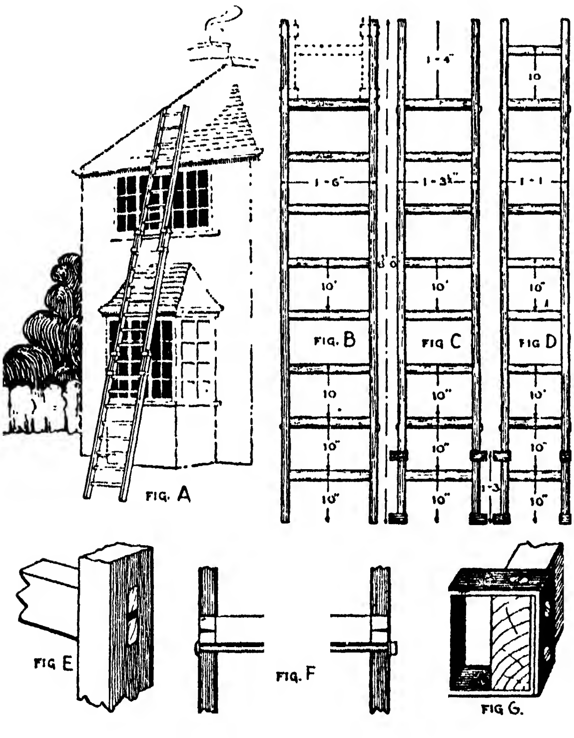
LADDER, EXTENDING

With the present-day charges for repairs and renovations, the house-owner who is anything of a handyman feels compelled to undertake as much of this work on his property as he possibly can. For work of this kind a ladder is the chief accessory, as it is necessary for most outside repairs and jobs of painting, while it is also useful for work inside the house. The ladder shown in Fig. A is an ideal one for the purpose mentioned. It is made in three 8 ft. sections, easy to assemble, and making a ladder long enough for most purposes, while the sections may be easily stored in the workshop or cellar without inconvenience. The work of making the ladder is quite straightforward, and is relatively inexpensive.

The Sections.—The three sections are shown in Figs. B, C, and D; they are made to fit one within the other, and are fixed together with

iron sockets. The middle section (Fig. C) is shown fitted above the bottom section (Fig. B) by dotted lines.

Deal may be used to make the ladder, but it must be good sound stuff, free from knots and shakes. The slides for all the sections should be 8 ft. long by 3 in. wide by $1\frac{1}{4}$ in. thick; in the lowest section there are eight rungs 1 ft. 6 in. long; in the middle section eight rungs 1 ft. $3\frac{1}{2}$ in. long, and in the top section nine rungs 1 ft. 1 in. long by $1\frac{1}{2}$ in. wide by 1 in. thick. The rungs are tenoned through the sides as shown in Figs. E and F, and in the positions shown in Figs. B, C, and D.



A Handy Extending Ladder.

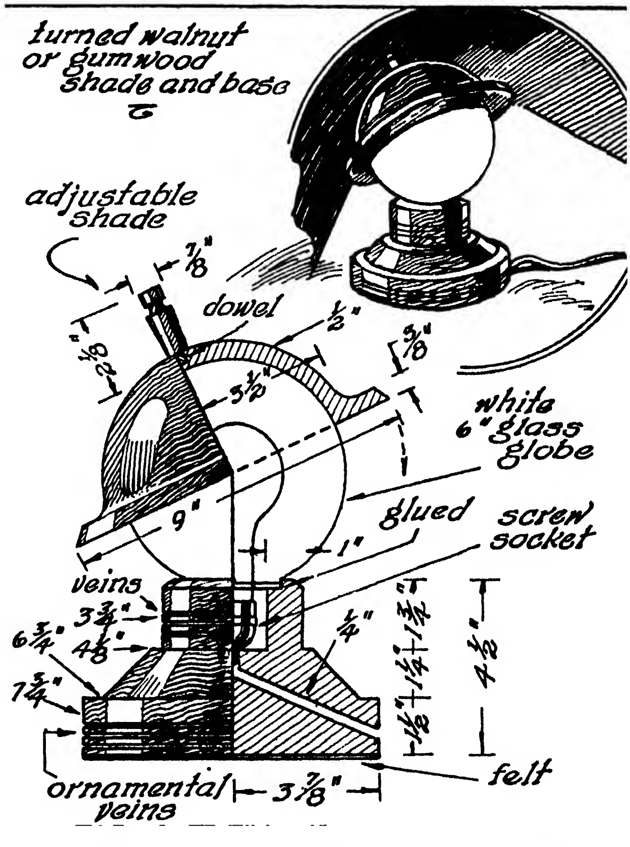
The Sockets.—The sockets by means of which the sections are fixed together should be formed from 2 in. by $\frac{1}{8}$ in. or $\frac{3}{16}$ in. hoop iron. It will not be necessary to weld up the sockets if two sides are overlapped, as shown in Fig. G, and each socket fixed with four screws, one in each edge and two on the flat. The sockets are fitted at the bottom ends of the sides of the middle and top sections, as shown in Figs. C and D, and they should be fixed before the rungs.

The Joints.—The joints between the rungs and sides should be painted previous to fixing, and the ends of the tenons should be wedged as shown in Figs. E and F, while the ladder would be greatly strengthened by fixing two long bolts, or a length of $\frac{5}{16}$ in. iron riveted with washers at each end, through the sections, as shown in Figs. B, C, D, and F.

LAMP, GLOBE MODERN PATTERN

Use walnut or figured oak for the shade and base of this unique hall or night lamp. Turn down the shade from a block 9 in. in diameter and $6\frac{1}{2}$ in. thick, to fit a 6 in. white glass globe as shown in the cross-diagram Turn down the inside of the bowl shade carefully to fit the globe, leaving a wall $\frac{1}{2}$ in. thick. The outside of the shade flares out to a bevelled $\frac{3}{8}$ in. rim. The turned knob, $\frac{7}{8}$ in. thick at its widest point near the top, and

2⅛ in. long overall, has a dowel turned at the lower end for gluing in a hole bored in the top of the shade. The base is turned from a block to a diameter of 7¾ in. and depth of 4½ in., the upper part of the base being 3⅞ in. in diameter and with the middle turned out for the bulb socket. Turn a flange around the top of the base to take the opening rim of the globe which should fit tightly. Bore a hole at an angle leading from the lower edge of the base to the hole bored in the socket opening for the screw socket, and lead the light cord through this hole. Three ornamental grooves or veins are cut on the lathe around the upper part of the base and also around the lower edge. A piece of felt glued to the base will protect furniture. French polish or wax and polish walnut, or if gumwood is used, finish with clear lacquer. If the globe used is a little larger or smaller than 6 in., the shade and upper part of the base can be altered in proportion.

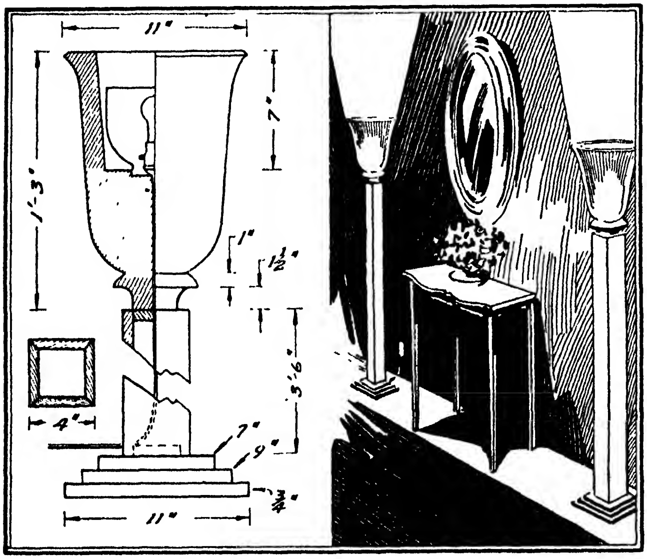


Globe-pattern Stand Lamp, made by Wood-turning Method.

LAMPS, URN PATTERN FOR THE HALL

These attractive urn lamps are intended for the hall or on one side of the living-room. They can be finished in ivory enamel or stained and coated with clear lacquer. Use glued-up blocks of pine, oak or mahogany, 15 in. long and 12 in. square at the ends for the lamps, first planing them down so they will turn on the lathe, and then turning them as shown in the cross-sectional diagram. The finished shade or urn is from 10½ in. to 11 in. in diameter at the top, curving to the base of the bell-shaped urn which is 4 in. in diameter where it joins an ornamental collar 1 in. thick. The extreme lower end of the piece is 3 in. in diameter. An opening is turned in the top of the shade to a depth of 7 in., and a circular depression is turned in the centre of the opening bottom, to take snugly

the rim of the reflector. A 6 in. reflector is used. Bore a $\frac{1}{4}$ in. hole through the centre of the shade for the light cord and fit a switch screw socket in the shade as shown. The standard or vertical shaft of the lamp is made from four boards 4 in. wide and 42 in. long, with the adjoining corners mitred. A block is fitted in the top and bottom of the hollow shaft, and a hole bored through the top block to correspond with the one in the lamp shade. Fasten the top block to the base of the shade with screws, centring it, and then nail the block in place with finishing nails. Half-inch stock is used for the sides of the standard, the mitred corners being glued and held with a few small finishing nails. The nails should be countersunk and covered with plastic wood or putty. The lower square block is attached with screws to the base, and the standard slipped over it and nailed in place. The base consists of three $\frac{3}{4}$ in. boards, one being 7 in. square, the next 9 in. square, and the last 11 in. square, the boards being centred and assembled with countersunk screws from the underside of the bottom board. For convenience a light switch can be attached to the outside of the standard near the base where the light cord passes through one side. Otherwise the light can be switched on by reaching inside the reflector.



Urn-pattern Lamps for the Hall.

PARQUET FLOORS, LAYING

This type of floor uses standard-size wooden blocks, resembling bricks, which are laid in various attractive patterns either over existing flooring or, preferably, direct on to concrete floors.

The usual size of block for laying over existing wooden floors measures 3 in. by 9 in. by $\frac{1}{4}$ to $\frac{1}{2}$ in. For concrete floors the blocks measure 3 in. by 9 in. by 1 in. thick. It is possible to use square-shaped blocks and with these some attractive diagonal patterns, as shown at C in the accompanying illustration, can be made. The squares usually measure from 6 in. to 8 in. side. When used over existing flooring the first requirement is to estimate the approximate number of blocks that will be required

(1) Timber of Hardwood, such as Oak, Beech, Ash, as well as Pine, about 3 in. wide by $\frac{3}{8}$ in. thick makes good Parquet Blocks. Use a Cutting Gauge as shown and saw off a sufficient number of Blocks.

(2) Lay the Pieces on the Floor (which must be flat) and secure each Piece with 1-in. Brass Panel Pins driven diagonally through the Edges.

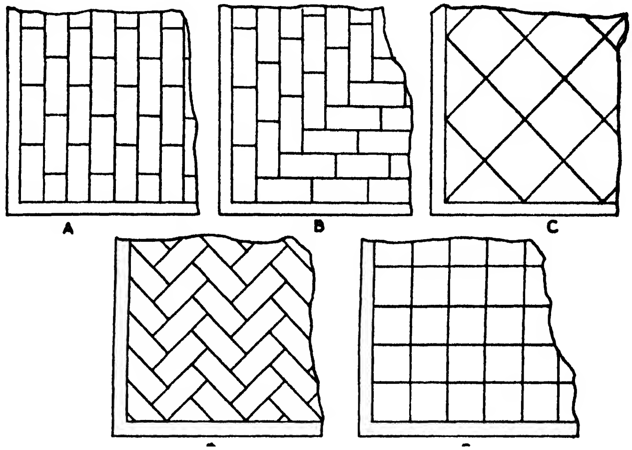
(3) Rub down the Surface vigorously with a Sandpaper Pad, as shown. Brush off all Dust and finish by Staining and Polishing.

HOME-MADE PARQUET FLOORING

by dividing the total area of the flooring (converted into square inches) by the area of one block.

Thus, if a room measures 14 by 12 ft., the area will be 14 × 12 × 144 sq. in. = 24,192 sq. in. If the 3 by 9 in. block is used, the area will be 27 sq. in. Dividing 24,192 by 27 we get 896 as the number of blocks. From this can be subtracted those not required for the fireplace, etc.

The flooring upon which the blocks are to be laid must be levelled off, if necessary, by planing the existing joints. See that the floor is quite clean. It is best when arranging the block pattern to have a distinctive edging so as to break the "bareness" of the blocks finishing against a plain wall or skirting. This edging can be made up of blocks or timber strips.



Alternative Schemes for Parquet Floors.

The blocks should be laid with their long sides, i.e. the 9 in. sides, in the direction of the longest side of the room and it is a good plan to lay the first row of blocks along the plain long side of the floor. The last block of this may now have to be cut in order to fit into place.

The blocks are stuck down to the flooring with strong floor glue. Marine or Scotch glue melted in a glue pot will do for this purpose. It is a good plan to nail down blocks of the tongued and grooved pattern without using glue; this is the same method as that described previously for oak flooring.

When laying a row of blocks tap sideways into position so as to obtain a good joint. Apply the glue to the bottom and side faces and wipe off any surplus glue from the edges with a damp cloth, so that none is left above the surface. Unless this is done the floor stain or polish will not take and the glue will leave unattractive patches.

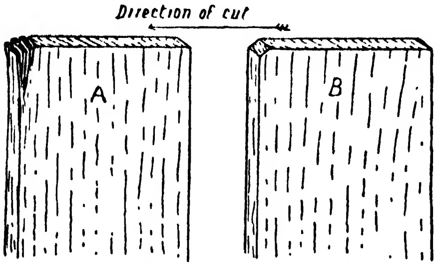
The final row may require a certain amount of "juggling" or even planing down of the edges in order to ensure a good fit between the last row but one and the surround or skirting board.

When the glue has set hard, level up the floor with a scraper and smooth off with sand-paper before staining or waxing over, as desired. Whilst oak and pine can be used for the blocks there are other timbers such as beech, maple, ash, sycamore, etc., which give attractive results. Care must be taken, before laying a parquet floor, to ensure that the blocks are thoroughly dry; otherwise unsatisfactory joints and poor adhesion to the existing flooring may occur.

When parquet blocks are laid over *a concrete floor*, it is important to have the surface of the latter clean and free from any projecting cement or loose particles. The adhesive employed to hold the blocks in position consists of 1 part pitch and 2 parts tar, the mixture being used warm. The blocks should be dipped to one-half their thickness in this composition and then pressed securely into position to make the joints.

PLANING END GRAIN

Planing the end grain of a piece of wood differs from, and is more troublesome than, ordinary planing. The plane needs to be sharp, the cutting very light, and if much reduction is necessary it must be done with a chisel, the plane only being used for finishing. Unless precautions are taken the wood will split away at the end of the plane stroke as illustrated at A. A way to prevent this is to chamfer the corner off with a chisel as at B. The plane then does not finish its cut against a weak edge which cannot resist the push of the cutter. With care the end may be planed until the chamfer has nearly disappeared, but the less the chamfer the greater the risk of splitting. When a chamfered corner is objectionable on the finished work the difficulty can be overcome by frequently reversing the direction of the plane and not allowing it to travel quite to the far edge of the wood. In some cases the chamfer can be removed by planing the ends before reducing the piece to width.



Corner at A broken away in planing the end grain. Corner at B chamfered to prevent it.

A Useful Planing Hint.

PLANING OAK AND OTHER HARD WOODS

Most hard wood is troublesome to plane owing to cross and curly grain, which tears up in places where the cutter is going the wrong way of its slope. Apart from having the plane in the best condition, the tearing up must be avoided by reversing the direction of the plane on patches which tear up. Very thin shavings must be taken and the surface finished with a cabinet-maker's scraper.

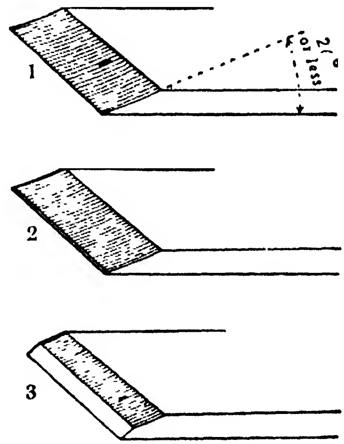


Fig. A.—Plane Irons at Different Stages of Sharpening: in order from above.—Ground before Sharpening; (1) after the first Sharpening; (2) after being used and (3) sharpened till it is in need of Regrinding.

If the planes are new, the angles their cutters are ground to at present will show you what they should be. The sharpening angle has unavoidably to be slightly more obtuse

than the grinding angle, because it is practically impossible to rub down the whole width of the latter on an oilstone. Fig. A shows suitable angles for grinding and sharpening. The acuteness of a cutting edge is limited by the need for sufficient strength to avoid breakage and to remain keen for a reasonable time in use, and therefore the angle for hard wood is slightly less acute than for soft. The cutter is ground to a thin edge, as in the first of the three views, and is sharpened with the least possible departure from the grinding angle. This sharpening edge gradually increases in width and generally in obtuseness of angle also.

The curvature of the edge in face view, shown in Fig. B, is important. A jack-plane edge has considerable curve to enable it to cut thick shavings, and at the same time keep its corners from digging into the wood, ridging the surface, and choking the plane. A smoothing plane has an edge which is almost straight except that the corners are slightly rounded up to prevent digging in. This allows it to cut a thin shaving nearly as wide as the cutter. On wood which tears up the back iron needs to be adjusted close to the cutting edge and the plane set for cutting the thinnest possible shavings.

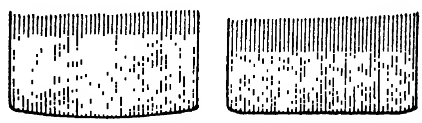


Fig. B.—Edges of Plane Irons viewed on the Face: Left, Jack Plane; Right, Smoothing Plane.

PLASTIC WOOD

Plastic wood is a proprietary product sold under the name "Necol," and is a material of the consistency of thick paste or moist dough. In this condition it will adhere firmly to wood, metal, or other material, provided the surface is free from grease. After exposure to air for an hour or two it dries hard, the resulting material being a waterproof substance free from any tendency to warp, crack, blister, peel, or crumble.

It resembles wood, except that it has no grain, and it can be worked with woodworking tools in a similar manner. Necol plastic wood contracts slightly on drying, so that a small allowance should be made when using this substance.

Articles can be built up entirely of plastic wood, in thin layers, each layer being allowed to harden before applying the next one. Plastic wood is particularly useful as a means of filling up holes in the surface of wood, such as nail, knot, and splinter cavities. It can be mixed with suitable pigments so as to match in colour the particular wood filled. This enables the filled surface to be varnished or french polished.

In furniture and cabinet work, defects in the surface can easily be filled and rendered practically invisible with plastic wood. Nail and screw holes can be filled and levelled off so as to be completely invisible.

When filling surface cavities with plastic wood, it is best to use rather more of the material, to allow for contraction, afterwards chiselling or planing it down flush with the surface. The plastic wood should be pressed firmly into the surface to which it has to adhere.

A warm current of air reduces the time required for hardening; a naked flame should not be used, however, as the vapour given off during hardening is inflammable.

In open-grain finishing, such as unfilled oak where plastic wood is used, say, for filling in screw holes, the lines of the grain can be imitated in the plastic-wood surface by tracing with a knife while the material is hardening.

For decorative work plastic wood can be used to build up ornamental additions to surfaces in a somewhat similar manner to Gesso.

RUSTY WOOD SCREWS, TO REMOVE

A good way of removing rusty screws is to apply a little vinegar, leaving it a few moments to penetrate before using the screwdriver. This method will prove effective when oil fails.

Automobile penetrating oil or even petrol or paraffin can be used for the same purpose.

SAW-BENCH

The accompanying illustrations indicate a useful article for the work shed or garden. In Fig. A we have a useful bench suitable for sawing logs and other pieces of wood.

Fig. A.—The Saw-bench as a Table.

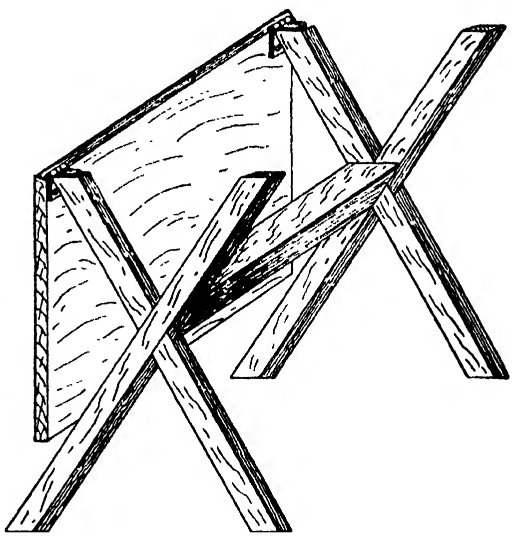
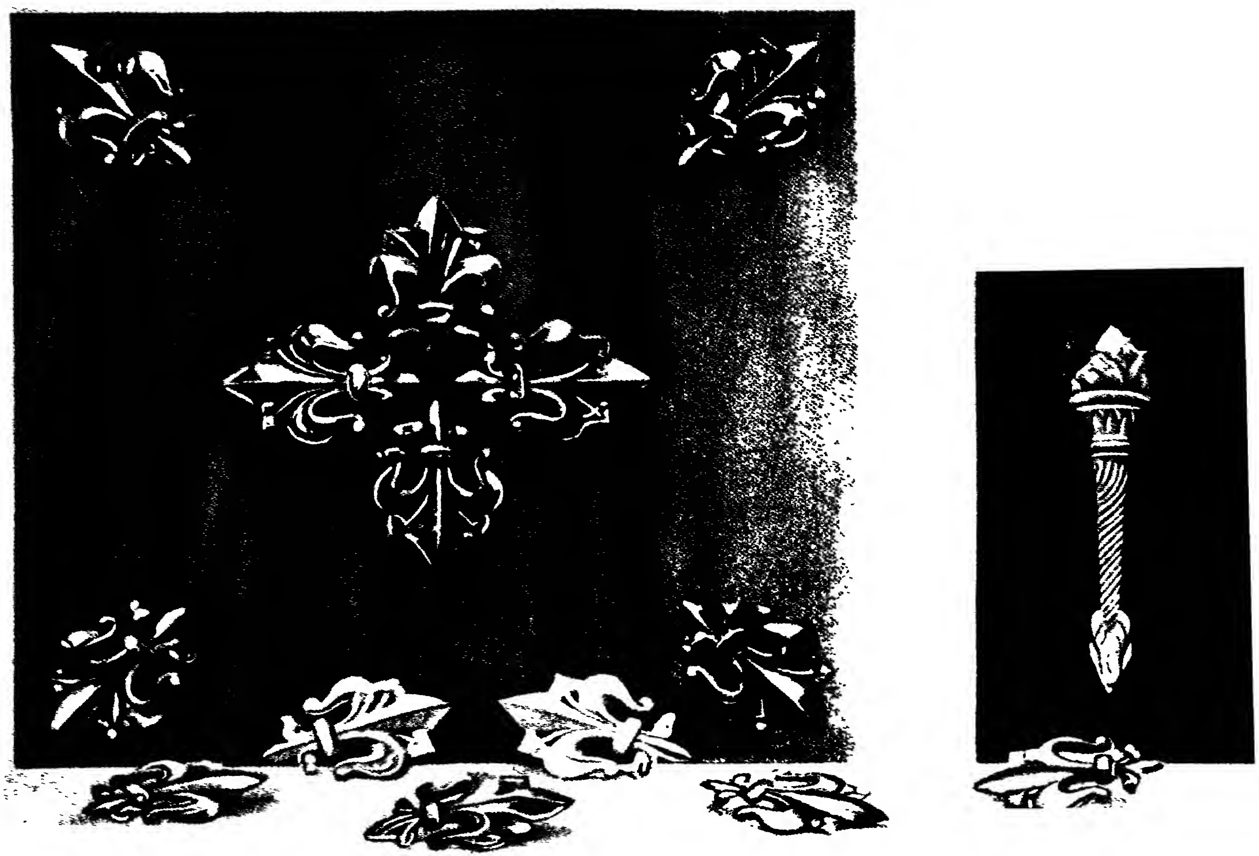


Fig. B.—Used as a Saw-bench.

By turning over the hinged board to the top, as indicated by Fig. B, a useful portable bench is formed.

The bench is quite simple to make, the size being varied to one's own requirements, therefore measurements are not given.

It is essential, however, that the article should be of ample strength, and 2 in. by 2 in. wood battens should be used for the supports for a



EXAMPLES OF MOULDED ORNAMENTS MADE OF PLASTIC WOOD AS USED FOR EMBOSSED EFFECTS.

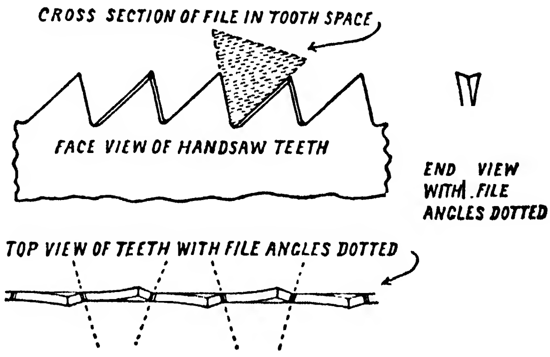
small bench, while 3 in. by 2 in. battens are more suitable for a larger bench. The supports are half-lapped, and fixed to the ends of the distance piece by means of screws, holes to receive them being previously drilled.

The bench top should be of strong wood from $\frac{3}{4}$ in. to 1 in. thick, according to the size of bench, and this is secured by two iron hinges, as clearly indicated in Fig. A. If desired, thin iron strips may be screwed to the bottom of the supports, which will tend to check wear and help to make the bench still more firm.

SAW SETTING AND SHARPENING

The following will assist the amateur in taking proper care of his saws.

The teeth of an ordinary handsaw are shown in the accompanying sketch. A rip saw differs from a cross-cut in having larger teeth with less set and less backward slope to the front edges, besides which the edges are filed almost at right angles to the blade instead of sloping as shown. When setting is necessary it is done before sharpening and it is important to have it uniform. It is generally done with a hand set, of which many varieties are sold, most of them being designed to bend each tooth to exactly the same extent. If when viewed from the end of the blade it is seen that the tooth points are not all of equal height, they must be made so by passing a flat file a few times along the tops to reduce the high ones. A three-corner file is used for sharpening and it fits into the tooth spaces as shown, filing the front of one tooth and the back of the next simultaneously, the saw being held teeth upwards in a vice. Two or more strokes may be necessary to each space to remove the dullness from the points, the file cutting deeper at the same time. To assist in holding the file at a uniform angle it is usual to go along the blade filing alternate teeth only and then do those which slope the other way, so avoiding continual reversal of direction with the file. The transverse slope of the edges must agree in direction with the set of the teeth, the acute edge being on the side to which the tooth leans.



Sharpening and Setting Wood Saws.

The following further notes on saw sharpening and setting will assist the woodworker to keep his handsaws in good condition.

Teeth Shapes.—The Figs. A to E illustrate clearly the various bevels, etc., which are necessary for the different types depicted. Fig. A shows the correct shape of ripping teeth, i.e. those of a saw used for cutting in the direction of, and parallel with, the grain of the timber only. In order to perform this function efficiently, it is necessary that the teeth carry a

large amount of what is known as "hook." In other words, they must point forwards towards the narrow end of the saw. The teeth shown by Fig. A possess the maximum amount which it is possible to give to this type, because if this "hook" is carried so far that the teeth become undercut, the saw " grabs " in the cut.

A triangular file should be used for sharpening all the types of teeth as this automatically makes the 60° angle gullets. The back of one tooth and the front of the next should be filed at the same time, and the file placed in each alternate gullet. Then when the saw has been sharpened in this manner from the one side, it must be turned round and the remaining teeth treated likewise from the other side.

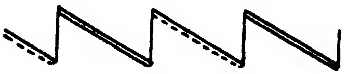


Fig. A.

Fig. B.

Fig. C.

Fig. D.

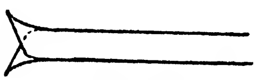


Fig. E.

Correct Shapes for Saw Teeth.

Handsaw.—The type of teeth illustrated by Fig. B is that of the ordinary handsaw, which is probably the most common of all. This type of saw is used for innumerable purposes, from ripping to cross-cutting, so that the teeth have to be a compromise between true ripping and cross-cutting teeth, in order that they will perform both these operations in a creditable manner. It will be noticed that the fronts are bevelled—about 25°. This is to enable the teeth to cross-cut in a clean manner, as during this operation the fibres of the timber have to be severed, which is a totally different process to that of ripping. By bevelling the fronts, the points are made into knife edges, which is the shape most calculated to produce this result. For a saw which is used exclusively for cross-cutting this bevel can be increased till the limit—45°—is reached. For general work a compromise has to be made.

A certain amount of " hook " should be given, as this is a help when ripping, but it should never be carried farther than shown in Fig. B. The sharpening is performed in exactly the same way as with the former type—that is, each alternate gullet is filed from the one side, and the remaining ones from the other. In every case the front of one tooth and the back of the next should be filed at the same time.

Panel Saw.—Fig. C illustrates the style of tooth used on what is known as the panel saw. These teeth are almost identical with the former type, except that they are on a smaller scale, being usually made with 10 points to the inch. As this kind of saw is used chiefly for cutting thin timber, the fronts of the teeth can be given more bevel, but not quite so much " hook " as Fig. B, as shown in the figure. The method of filing

is exactly the same, but care should be taken to get a small file for these finer-tooth saws, as the larger ones have too big a corner for these.

Tenon Saw.—The tenon-saw teeth illustrated by Fig. D are to all intents and purposes the same as those shown in Fig. C, as far as shape is concerned. However, they are intended for finer work and are consequently made smaller.

Setting.—Another item which is quite as important as the sharpening is that of setting—that is, the bending of the teeth alternately to the right and left, so that they will cut a kerf wide enough to enable the plate of the saw to clear without undue friction, as it works through the timber. When correctly set and sharpened the teeth should look like Fig. E, when examined from either end of the saw, and a fine needle should slide from one end of the saw to the other in the groove made by the bevel on the teeth.

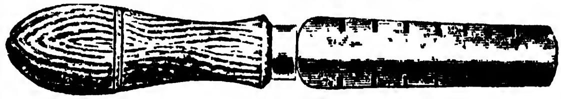


Fig. F.—Saw Tooth Setting Tool.

The earlier method of using a hammer, punch and lead block for the purpose of setting saw teeth has now given place to the saw setting tools shown in Figs. F and G. Of these the slotted plate is the older tool which has now been largely superseded by the pliers type of setting tool shown in Fig. G. The slotted plate tool was used, edgewise, with the appropriate width of slot placed over the saw tooth to be bent sideways. The chief drawback with this kind of saw set is that it is not easy to set all of the teeth to the same angle. The type of saw setter shown in Fig. G will set all the teeth by the same angle and there is an adjustment provided in most designs for altering the tooth-setting angle within the required range. This tool is merely inserted over the teeth of the saw, with the central punch portion directly over the tooth to be bent. The handles are then pressed together as far as they are permitted by the adjustable stop, when the tooth is set to the desired angle.

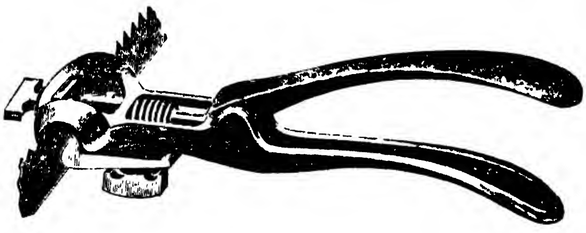


Fig. G.—Saw Tooth Setter of the Pliers Type.

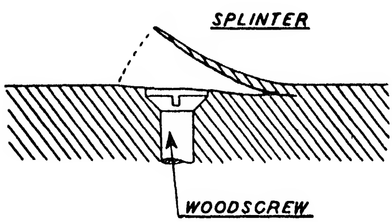
Care should be taken to see that when sharpening, one range of the teeth shall not be higher than the other, or the saw will lead in the direction of the highest teeth, and instead of cutting straight will describe a curve. To obviate this, the saw or saws should be ranged down slightly, about once in every three sharpenings. This is done by running a flat file lightly over the points of the teeth from one end of the saw to the other. The flat file should be held perfectly square with the plate of the saw, or it will defeat its object. The teeth are then sharpened till the mark left by the flat file is just removed and no more, after which the saw should be in perfect condition.

SCREW REMOVAL

Before driving a screw into wood, dip the point into tallow or some other grease. Then the screw will go in more easily.

Screws which have been in position long are often difficult to remove. If a screw is hard to turn, place the screwdriver in position, and give it two or three sharp blows with mallet or hammer. If this does not loosen the screw, heat a poker, and put in on the head of the screw. This, becoming heated, will expand, and upon again cooling will be found sufficiently loose to be unscrewed.

When the head of a screw has been so damaged that the screwdriver will not grip, it can sometimes be repaired with a little solder, so as to enable the screw to be withdrawn. Scratch the screw until the metal shows bright, apply some Fluxite and fix a " blob " of solder. When the solder is cool cut a slot in it with a hacksaw blade or a ward file to receive the end of the screwdriver. This method can only be expected to succeed when the screws are 2 in. or less in length, as the solder is too soft to resist the pressure necessary to turn longer screws which have been in position for some time.



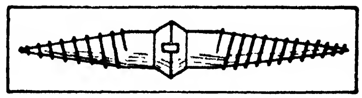
Concealing Head of Screw.

SCREWS, CONCEALING HEADS OF

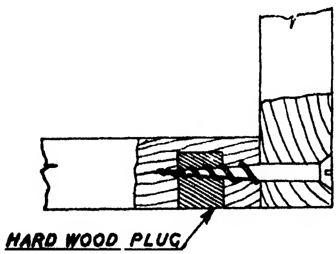
To conceal the head of a countersunk screw as in fine furniture construction, prise up a splinter, insert the screw, and glue the splinter as neatly as possible in place again.

SCREWS, DOUBLE-ENDED WOOD

Double-ended screws are particularly useful for domestic repair work such as for fixing the legs of chairs, stools, and tables in place, and for door-knob fixing.


A Useful Double-ended Screw.

The double-ended screw shown in sketch can be made at a moment's notice, as follows: All you have to do is to tin the heads of two screws and solder them together. Two screws with opposite threads should be used. In use they can be turned by means of a piece of wire pushed through the hole formed by both slits.



Screws in End-grain Wood.

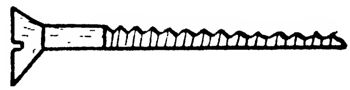
SCREWS IN END-GRAIN WOOD

It is a well-known fact that wood screws will not hold satisfactorily in end grain, so that wooden members secured to the end grain of other members are not always rigid. To obviate this difficulty the method illustrated may be followed with fully satisfactory

results. A hole is bored into the end-grain member and a hard-wood plug is driven into this hole, or if there is a risk of splitting the wood it may be glued into position. The wood screw will now be able to obtain a firm grip on the plug and thus give a tight joint.

SCREWS, TO PUT IN HARD WOOD

The usual methods of inserting screws in hard wood or ivory are to bore a hole and plug with soft wood, or more often, to make the hole so large that the screw has no hold. Neither way is lasting. If the following plan is carried out the screw will remain fast for ever with no risk of turning off head of screw.


Half-screw for Tapping Hard Wood.

Take one of the screws required of any size and file *exactly half away*. Bore hole in the hard wood the correct size and depth, insert the half screw, which will cut a perfect thread (as a tap), unscrew it, and it will be found that the whole screw will enter perfectly. The unthreaded part of screw, of course, requires the hole to be slightly larger.

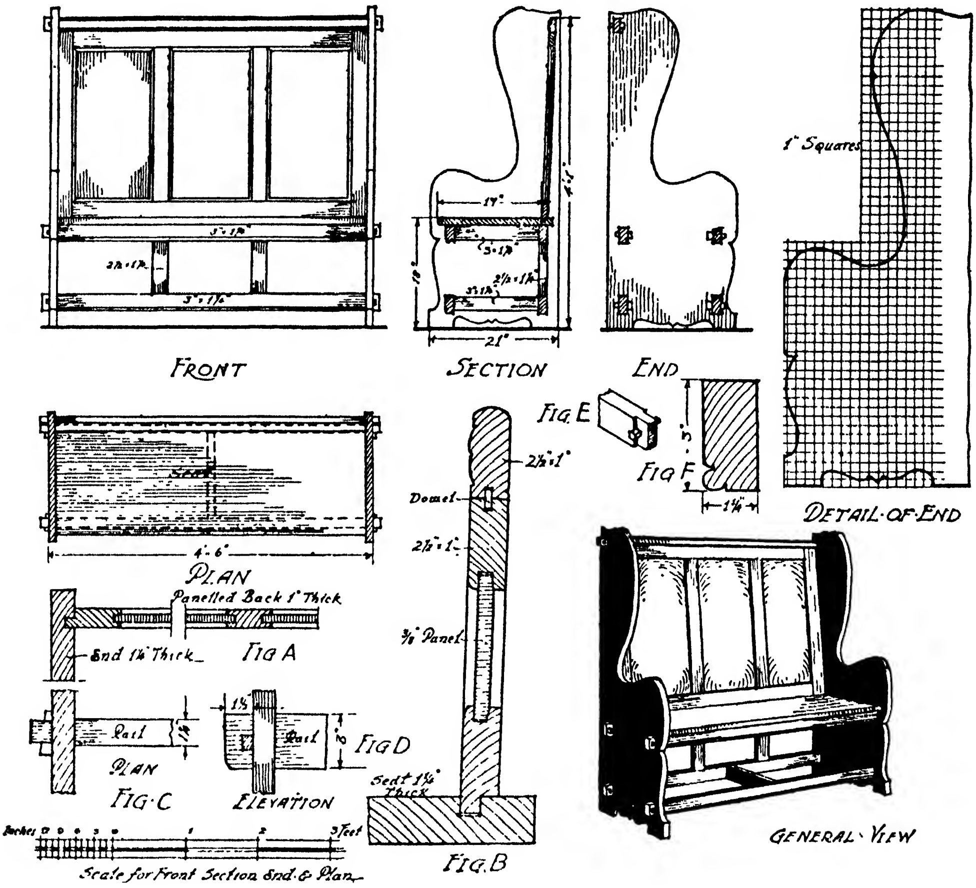
SETTLE FOR A SMALL HALL

In the modern house the hall is usually of small dimensions and not suited to take any large pieces of furniture. At the same time, the hall, however tiny, requires some furnishing—and what is more suitable than a small seat or settle?

The accompanying drawings show a design for such a piece of hall furniture, constructed in oak, waxed and polished. It is easy to make, and besides being of a decorative character has also a utilitarian purpose.

Construction.—Dealing with the construction, the ends are $1\frac{1}{4}$ in. thick, made up in three widths, tongued and glued together and shaped as shown in the drawings. Five openings, 3 in. deep by $\frac{3}{4}$ in. wide, are cut in each end to take the ends of the rails under the seat, at the bottom, and the top moulded rail above the panelled back. The rails under the seat, and the bottom rails, are 3 in. deep by $1\frac{1}{4}$ in. thick and project about $1\frac{1}{2}$ in. beyond the outer face of the ends. Before passing through the ends, they are reduced to $\frac{3}{4}$ in. thick, whilst the ends of the projecting parts are finished by being rounded on the lower edge. Openings are cut in the former, through which—after the rails are fixed in position between the ends—short wedges are driven to hold the rails in position. Figs. C, D, and E provide a plan, elevation, and isometric view of the rails, while Fig. F gives a section of the two front rails which are moulded along their lower edges between the ends of the seat. A cross-bearer, 3 in. by $1\frac{1}{4}$ in., is tenoned into the back and front rails under the seat, and also between the bottom back and front rails, whilst between the back rail under the seat and the back bottom rail are stub tenoned two short pieces $2\frac{1}{2}$ in. broad by $1\frac{1}{4}$ in. thick.

The Seat.—The seat from back to front is 19 in. broad, rounded on edge, raggled into the ends and rabbeted to take the panelled back. The latter is framed up with stiles and rails, 1 in. thick and showing $2\frac{1}{2}$ in. on face, with rounded arrises on the front face only, the panels being $\frac{3}{4}$ in. thick. Figs. A and B show the construction of the panelled back. The back slopes about $\frac{3}{4}$ in. and is glued and screwed into raggles, $\frac{1}{4}$ in. deep,



Constructional Details of Oak Settle.

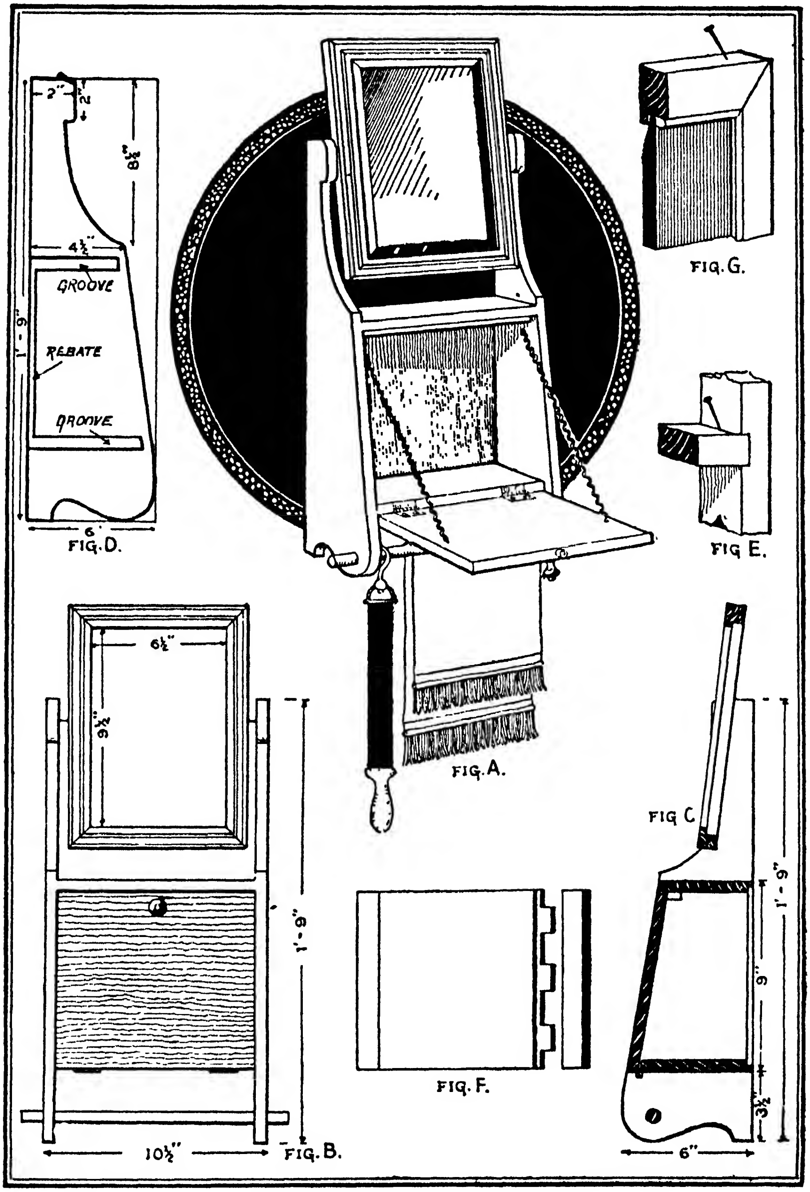
cut in the ends, whilst it is also tongued into the seat as illustrated in Fig. B.

The moulded member on the top of the panelling is $2\frac{1}{2}$ in. deep and 1 in. thick and is fixed to the top rail by means of $\frac{3}{8}$ in. dowels. Where the rail passes through the ends, it is reduced to $\frac{3}{4}$ in. thick and wedged into position in similar fashion to the other rails.

Suitable Woods.—Although oak is suggested as the most suitable timber to use, Oregon pine or cypress, stained and varnished, would be quite suitable.

SHAVING CABINET

The shaving cabinet shown in Fig. A is simple and inexpensive to make, the two shaped sides being jointed by top and bottom shelves,



A Well-designed Shaving Cabinet.

and a flap is hinged to the bottom shelf, a framed mirror is fitted at the top, and a towel rod may be fitted at the bottom. Pine stained to imitate a better wood could be used, but seeing only a small quantity is needed

for the construction, it is just as well to select a choice wood and save the task of staining. A cabinet made in oak should be wax-finished; or one made in walnut or mahogany, french polished. The main dimensions are given in the elevation and section, Figs. B and C.

Construction.—The sides should be cut from two pieces of wood, 1 ft. 9 in. long by 6 in. wide by ½ in. thick, to the pattern shown at Fig. D. The top shelf is 9¾ in. long by 4½ in. wide, and the bottom shelf 9¾ in. long by 5½ in. wide by ½ in. thick. The simplest way to fix the shelves to the sides is to cut grooves ⅛ in. deep in the latter to receive the ends of the shelves, as shown at Fig. D, the grooves finishing ½ in. in from the front edges of the sides. The shelves are then fitted into these grooves, the front edge of the top shelf being notched in ½ in. to bring it level with the front edges of the sides. The back edges of the sides and shelves are rabbeted ¼ in. square to receive the back of the cabinet, as shown at Figs. C and D. The towel rod should be 13 in. long by ½ in. diameter, bored right through the two sides. To fix the parts together, the shelves are glued into grooves in the sides and fixed with pins, as shown at Fig. E, and the rod is glued in place. The back, which may be of ¼ in. plywood, is cut to fit into the rabbets, and fixed with small pins.

The flap could be a solid piece of wood 9½ in. long by 8½ in. wide by ½ in. thick, or it may be strengthened by framing on two battens at the ends, as shown at Fig. F. The flap is hinged to the bottom shelf and fitted with a knob and ball-catch for opening and shutting, while two small brass chains should be employed to hold it when open.

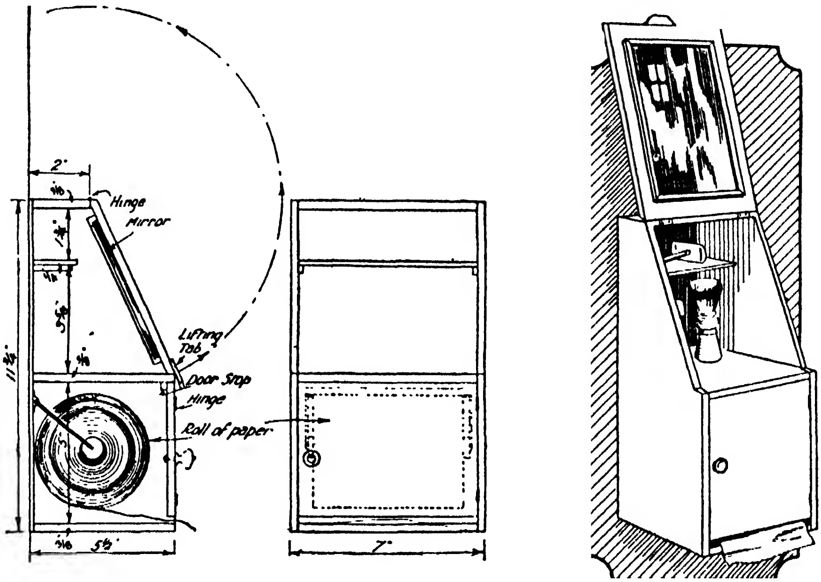
Mirror.—The mirror should measure 10 in. by 7 in., and for the sake of appearance should have bevelled edges. It is mounted in a frame which should be mitred up exactly in the same way as a picture frame, the corners being glued and nailed. The moulding should be 1 in. wide by ¾ in. thick, and rabbeted ½ in. by ¼ in. to receive the mirror, which is fixed with small fillets, as shown at Fig. G, and protected with a thin plywood back screwed behind the frame. The mirror frame is pivoted to the cabinet with a pair of brass mirror movements, fixed about 1 in. above the centre of the frame. These movements may be purchased from any wood-worker's supply stores, and should measure ½ in. between frame and pillar.

Another Design.—The cabinet illustrated is a neat, attractive, and useful addition to the bathroom, taking but little wall space and enabling your shaving materials to be self-contained and tidy; a tooth-brush rack can also be added if desired.

The sides, bottom, main shelf, and doors are cut from ⅜ in. thick board; the back and small shelf from ¼ in. hard wood, or a piece of glass may be used for shelf.

The mirror is framed with a plain, mitred picture-frame moulding, the groove being of a suitable depth to take the thickness of mirror that is available; several thicknesses of brown or newspaper should be placed behind glass to form a cushion.

Fitting the Parts.—The mitreing of the frame should be a very tight fit and glued and pinned, as should be the mirror frame to the lid; brass hinges should be fitted, and a lifting-tab about $\frac{1}{4}$ in. thick should be screwed to lower part of lid. The lower door should be fitted with a



An Alternative Type of Shaving Cabinet.

small glass knob and a spring ball catch; this lower door is to enable the paper roll to be renewed, the latter being fitted on an ordinary toilet-roll fitting.

The whole of the woodwork, both inside and out, should be painted with one coat of flat and two coats of good white enamel (except inside lower cabinet, one coat of flat will do for this), special care being taken to coat all joints, especially of the mirror framing.

SPLICED JOINTS

Most woodworkers are aware of the uses of spliced joints, but many people avoid the joining of two pieces of timber if they can possibly help it, on the ground that it is not possible to make such joints strong enough.

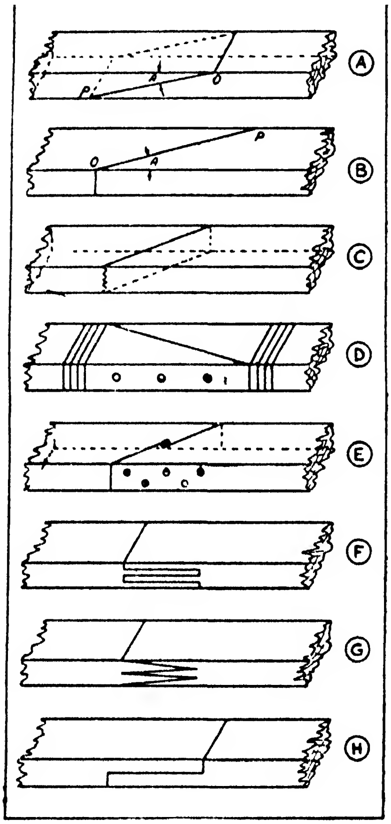
This is incorrect, and if the joint is properly made it can be made nearly if not as strong as the rest of the wooden members.

As it is not economical to waste the shorter pieces of timber, nor is it always possible to find sufficiently long pieces to make long articles, it is often a big advantage to be able to make a good, strong splice.

Once it is found that the woodworker can make strong and neat joints, he will get into the habit of using these, rather than scrap his available timber for longer pieces. There was not very much reliable

practical information on the subject of spliced joint strengths until during the war the aeroplane builders found that it was necessary, owing to the long lengths of the wooden parts used in aeroplanes, and also owing to the growing scarcity of imported timber (chiefly spruce), to use spliced joints.

All kinds of spliced joints were made up and tested by bending and stretching, and also by compressing, so as to find out which gave the best results. It was then possible to lay down certain sizes for spliced joints and methods of making these joints so as to give the same strength in bending and stretching as the rest of the timber.



Showing the Various Kinds of Splices for Wood.

The Glue.—The kind of glue used in making a joint in timber is very important; but there are some good glues available on the market, of which Croid glue is probably the strongest. This glue is much used for aeroplane joints. Another waterproof glue is that made from a milk product known as casein; it is chiefly used for plywoods.

The Gluing Surface.—Another important factor in obtaining strong splices is the amount of area of the surface glue. It has been found that splices with big gluing surfaces give the strongest joints.

The simplest splice is the plain scarfed one shown in A. The timbers are simply cut on the level and the two parts glued together on the slanting faces. If the timber is cut so that the face of the splice OP is short or in other words if the angle marked A is big, the joint will be a weak one. The reason for this is that the glued surface largely consists of end grain, which soaks up the glue and does not make a good adhesion.

Most woodworkers know how unsatisfactory it is to try to make end-grain glued joints. The best simple scarfed splice is the one with a long side OP or small angle A.

A scarfed joint with an angle A of 1 in 4 gives a strength of only one-half that of the solid timber, even if is pegged or screwed. On the other hand, if the joint has an angle of 1 in 8, and wooden pegs are fitted along the centre line of the spar, it has a strength of nine-tenths that of the solid spar.

A still stronger joint can be made by giving it a longer slope, viz. about 1 in 12, and putting the face of the splice vertical (as shown at B in the diagrams).

Using Tape to Strengthen Joint.—If a spliced joint be bound with linen tape, well glued and pulled tight, it will be strengthened. The joint just described can be made at least as strong as the timber itself if it is pegged and taped as shown in sketch D. All aeroplane wing and fuselage longeron joints where spliced were made in this way.

Another way to strengthen a spliced joint is to serrate or zigzag the gluing surface as shown in sketch C. This gives a bigger area of gluing surface and so increases the strength.

The ideal scarfed joint is that used officially for aeroplane spars. It has an angle of 1 in 9, and is pegged or bolted in seven places evenly spaced. Afterwards it is wrapped with doped or glued fabric three layers thick for about a third of its length from each end.

Wedged Splice.—Another way of making splice joints is given in sketch E. This has a kind of Z-shaped section as seen on the top. A wedge is fitted where shown by the black portion. This gives a fairly strong joint about three-quarters the strength of the timber itself.

Tabled and Fingered Splices.—Another kind of splice is the one shown in the sketch. Here the glued surfaces are horizontal.

By making a number of horizontal surfaces, that is by duplicating the tabled joint, we get the fingered splice shown in F. This is a very strong joint, and if it is properly made and pegged will give almost the strength of the wood itself.

Sometimes the fingered splice is made with zigzag or sloping sides, as shown in sketch G. This gives a slightly better joint, but there is little in it. The last one, shown at H, is rather easier to make.

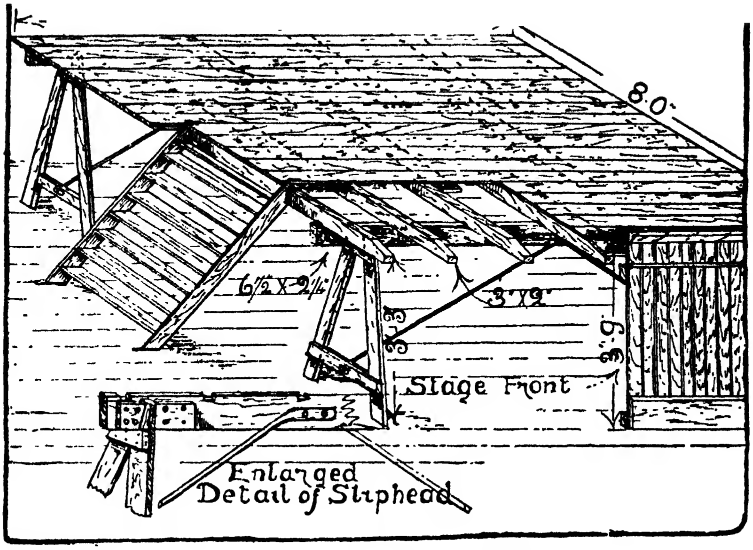
In conclusion, it ought to be mentioned that there are several other kinds of spliced joints, but the ones we have described are those which have been proved to give the strongest results in actual practice.

STAGE, FOR TEMPORARY USE

A temporary stage, easy to remove and store away, is illustrated in the accompanying drawing.

The strength of timbers shown is ample for the dimensions supplied, 10 ft. by 8 ft. It is intended that the slip heads be from 4 in. by $1\frac{1}{4}$ in. stuff and when 3 in. off the plumb to be secured to that position by screwed-down cleats; the provision of $\frac{5}{8}$ in. iron stays bolted through the ledger and hooked to an eyelet plate fixed to the cross-bar will be sufficient for the span.

The ledgers are notched $\frac{3}{4}$ in. deep to secure the 3 in. by 2 in. joists, while the flooring should be of six-board sections and the battens so arranged that they grip the joists. The splayed board for the footlights is laid in separately and kept in position by the stage front composed of V-matchboarding and grained and held in position by hooks to the feet of the slipheads and joists. The feet of the sliphead should be plumb with the joists end as a further method of securing the front. The steps



Construction of a Temporary Stage.

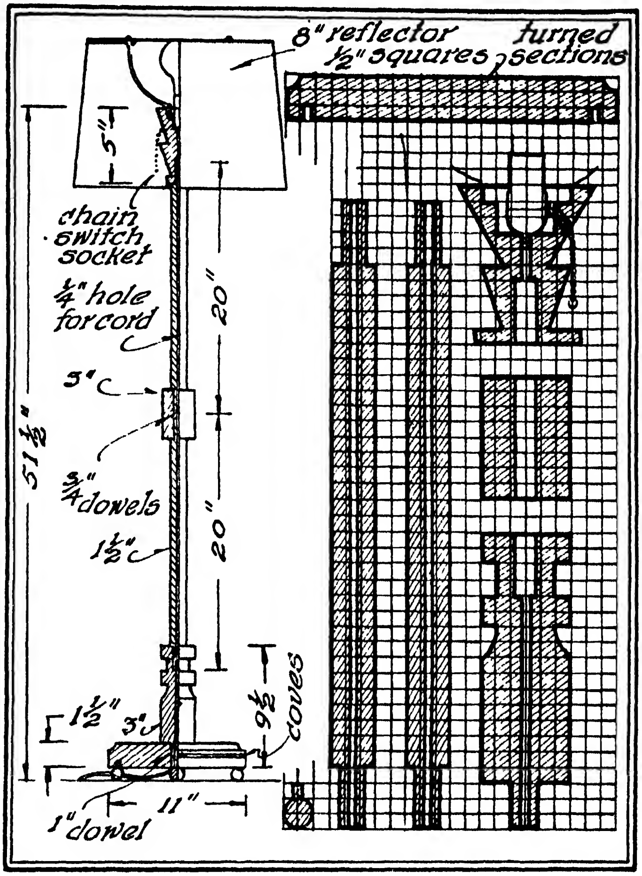
are 2 ft. 3 in. wide and secured by angle irons screwed top and bottom. The provision of a handrail if desired could be attained by iron rods flattened out and screwed to the stringboard.

STANDARD LAMP IN TURNED WOOD

The two 20 in. turned sections of the upright for the floor lamp illustrated can be increased 6 in. each if one requires a taller lamp than the 51½ in. lamp shown. There are six turned pieces comprising the wood stand, together with four ball-feet glued to the lower side of the base. A 10 in. or 8 in. reflector, 100 watt frosted bulb, chain switch socket and suitable silk or parchment shade in cream or tan tones completes the lamp. The 3 in. joining block at the middle of the upright, together with the turned block directly above the base, can be turned from hard maple, and the other pieces from walnut or beech to give two tones of wood, or the wood pieces can all be walnut, or plain beech.

The base is 11 in. in diameter and 1½ in.thick, the upper edge turned as shown, and two narrow veins or grooves being cut around the upper part of the base. Four equidistant ¼ in. holes are bored around the under side of the base, ½ in. from the edge, to take the four turned ball feet shown in the ½ in. scale diagram. The block directly above the base is 3 in. thick and 9½ in. high including a 1 in. dowel, 1½ in. long turned at the lower end which is glued in the centre of the base. The upper part of the block is turned in four segments, each 1 in. wide, as shown. The two long sections are identical, being 1½ in. thick with ¾ in. dowels, 2 in. long, turned at the ends. A turned block 4 in. long and 3 in. thick, having a ¾ in. hole bored through the centre, takes the adjoining dowel ends of the two sections. The socket block at the top is 5 in. high and 4½ in. in

diameter at the top, the turning and boring, inside and out, for socket, socket chain and dowel being shown in the cross-diagram on the scale drawing. Note that the diameter at the bottom of the block is 3½ in., forming a ½ in. flange above the adjoining wooden rod. Centred ¼ in. holes are bored in all the pieces to take the light cord. Walnut can be french-finished on the lathe, the pieces then assembled. Maple should be given a stain and varnish finish to add a yellow tone to the wood. Plain beech looks well in natural colour without stain, but finished in clear lacquer. Fasten the socket in place, running the cord through the pieces before assembling with glue. The turned opening in the top of the socket block should take the reflector snugly, but if you want it securely fastened, bore small holes around the upper edge of the block to take brass clamp screws, locking the reflector on the inside of the block.



A Standard Lamp with Turned Wood Parts.

STEPS, FOLDING

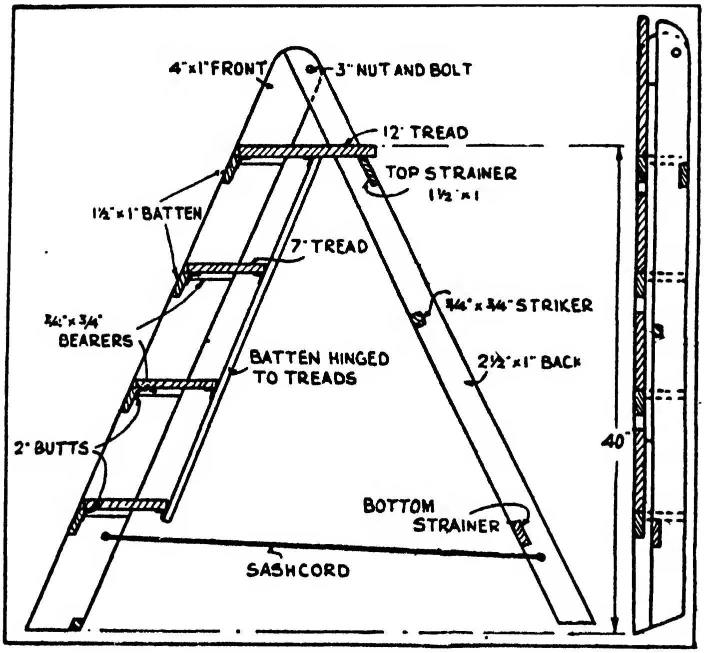
The pair of steps described here, although fitted with 7 in. treads, can be folded up to go in a recess only 4 in. deep.

The construction is as follows :

The two sides of the front portion are first made from 4 in. by 1 in., the bottom being bevelled to allow slope of steps, and bearing cleats are screwed on the inside faces to required heights of treads on the same bevel as the bottom is cut, allowance being made in the length for the sides to continue above the height of the top tread. Next cut notches in the front to allow a 1½ in. by 1 in. planed batten to come flush with front at the same height as the bearer cleats, extending across and connecting

sides a distance of 13 in. apart, the sides being parallel. To each of these battens is hinged by two 2 in. butts a 7 in. by 1 in. tread, $11\frac{1}{2}$ in. wide.

The back portion is of $2\frac{1}{2}$ in. by 1 in. wood, with an overall width of $11\frac{1}{2}$ in., and is connected to front portion at the top by a 3 in. bolt and nut each side so as to form a hinge. A distance piece, 3 in. wide, is placed on each bolt to allow for thickness of bearer cleats.



Useful Steps for the Home.

The sides of back portion are held in position by two strainers as shown in the drawing.

To the under side of top tread and to backs of other treads at centre is hinged a $\frac{3}{4}$ in by $\frac{3}{4}$ in. batten. This causes treads to hinge simultaneously when steps are being closed. A piece of batten across back portion strikes against the batten, connecting the treads when closing and lifts the treads together. The back portion, when closed, drops in between the bearer cleats of the front portion. To ensure rigidity of front portion, a $\frac{3}{4}$ in. by $\frac{3}{4}$ in. batten is screwed to back of front portion at the bottom, the back being $\frac{3}{4}$ in. shorter to allow for this. The top is rounded off after completion.

TABLE, ANTIQUE

The narrow Stuart table, sometimes called the Refectory table, is rapidly increasing in popularity as a feature of the "living-room" or dining-room of the small house or cottage. With its framed trusses or bulbous pillar supports it harmonises readily with a great range of furniture in oak that is somewhat loosely described as Jacobean.

The special utility of this narrow refectory table, with its long, narrow top and simple supports, can be seen well illustrated in modern furnishing schemes. In some country cottages the "living-room" or lounge is the most important room, and it is desirable to scheme the furnishing appointments so as to preserve the sense of spaciousness. In such a room a table of this kind can be allotted a permanent position within

a square bay window in such a way that window seats form the usual accommodation for diners round three of its sides. And quite a charming arrangement, too, with a maximum of light and air and a garden outlook, leaving the centre of the room available for movement.

Constructing a Refectory Table.—The refectory table is one of the simplest types of table for the amateur to construct. The proportions for the top should be 5 ft. by 2 ft. 6 in. wide or 6 ft. by 3 ft. wide, and if the length was still farther extended the width would not be more than 3 ft. The height over all should be 28 in. to 29 in.

There might be an advantage in constructing it so that at any time it could be knocked down into three or four parts for moving. This would be an easy task if constructed according to the illustrated details given.

The Top.—The top is framed up with a series of panels, the joints masked by beads in the manner known to joiners as " bead and flush."

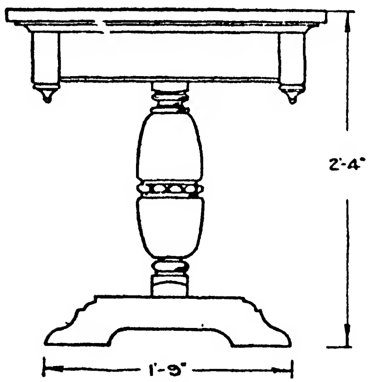


Fig. A.—End View of Refectory Table.

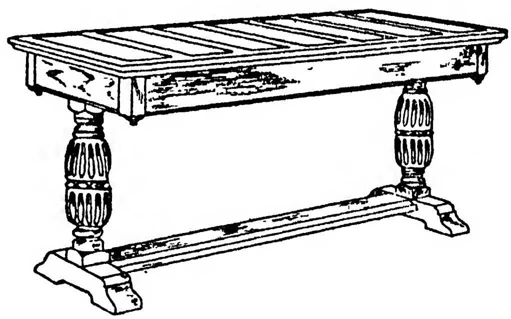


Fig. B.—General View of Refectory Table.

This top should finish 1¼ in. or full 1⅛ in. in thickness. It would be secured with screws or buttons to the top frame. This has four squares, 2¼ in. by 2¼ in., with turned finials and the rails are 1½ in. by 3 in., mortised and tenoned, and blocked at the corners, with the end rails thickened inside at the centres to provide a bearing for the turned pillars, which are bolted to the end rails with long bolts that engage a nut sunk into the centre of the columns. These pillars have short pins entering the bases, to which the stretcher is dovetailed from underneath, and a bolt right through into the pillar secures the whole.

A slip about ⅜ in. thick with beaded edge gives a finish to the lower edges of the framing rails, which are sometimes enriched with a series of vertical flutes or carved pattern of slight relief. The top is rendered bolder in appearance if its edge is thickened by a ¾ in. slip mitred all round, set back slightly from the edge of the top and having a cavetto moulding worked upon it. The corners of the top should be rounded slightly, and the pillars out of 3½ in. by 3½ in. thickened up to 5½ in. or

$6\frac{1}{2}$ in. in the centres are enriched with flutes and pateras, which last can be purchased and glued into positions slightly recessed by boring, or

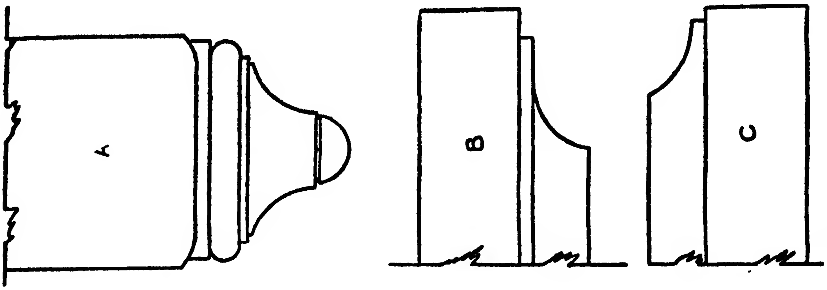


Fig. D.—Details of Mouldings.

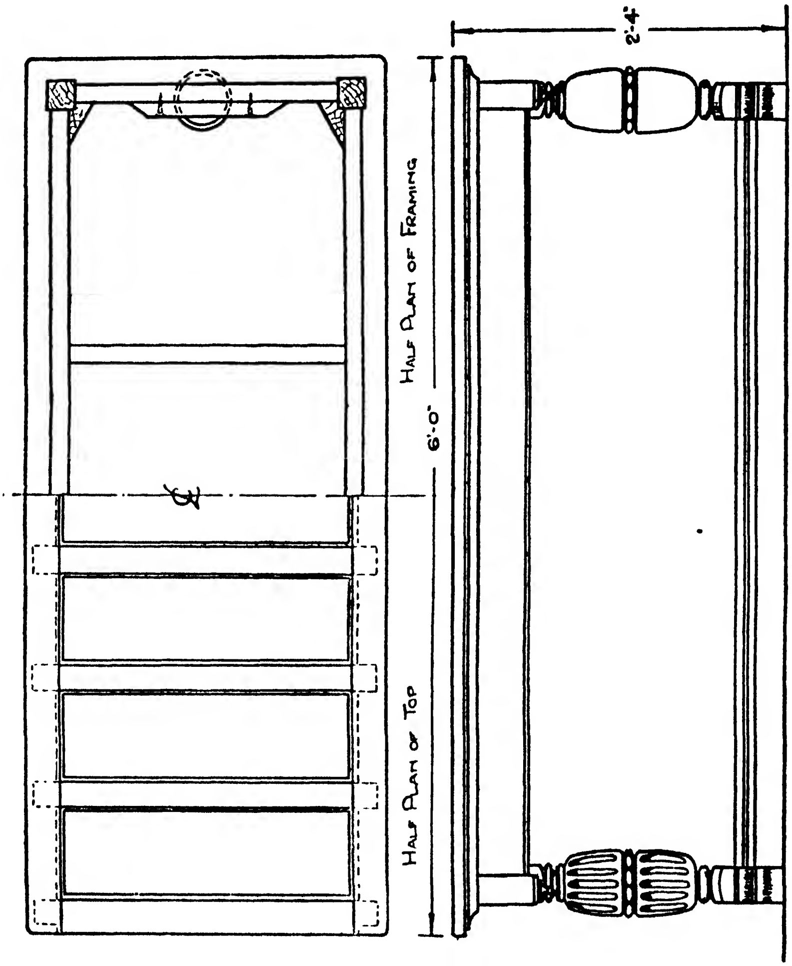


Fig. C.—Plan and Side Views of the Table.

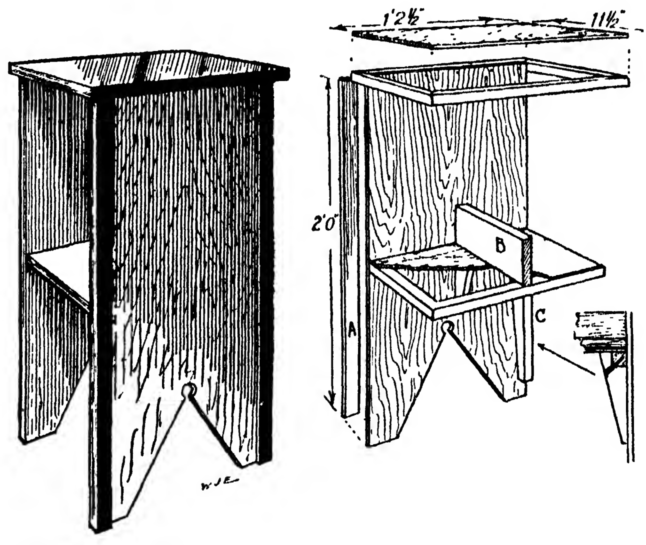
alternatively, they can be carved in the solid. The finials, also, instead of being turned out of the solid squares can be attached afterwards. The finish should be a waxed surface after staining to desired colour.

TABLE, BEDSIDE, INEXPENSIVE

When shortage of wood, or increase of prices, urges the woodworker to look elsewhere for his materials, boxes should not be despised since they furnish wood for many parts, and in the absence of the usual plywood a tea chest makes quite a good substitute.

The illustrations show a bedside and occasional table, made from the above materials. The dimensions given are from a table made from a tea chest, costing very little. As these may vary in size quite a lot, the reader should measure up any tea chest he may acquire and amend, if necessary, the given sizes.

The sides of the chest, only, were used, these being the best parts. The lid was damaged but the bottom was good enough to form the basis of a tea tray. A diagram of the table is shown, with one side removed to reveal its construction. The framing strips, used to stiffen the chest, provided the material for the top and shelf frames. Cut the top panel to size and make up an underframe to fit it. This frame is mitred at the corners, glued and nailed just like a picture frame.



Inexpensive Bedside Table, made from a Tea Chest.

The shelf frame is made of a size to fit inside the top frame, with space each side to admit the plywood sides of the table. Cover this frame with a plywood top, glued and pinned. Cut the table sides to dimensions and shape up the lower portions.

The side edges look better if thickened with strips of wood, as at A, glued all along. A pair of blind laths provided these strips. Nail the sides inside the top frame and the shelf between, about half-way down. Strengthen all joints with glue when nailing.

Across the middle of the shelf nail a piece of ¾ in. wood, 3 in. high, as at B, and below, in the angles, nail brackets as at C to stiffen the lower half of the table. These parts can be sawn from a box. Glue the brackets in and fasten with a single nail, or screw, where shown in detail sketch. Now glue the plywood table top on.

Trim up the edges with a plane and then go all over the table with

medium and fine glass-paper. A good scouring is necessary as the plywood is usually not of good quality.

For the above reason painting or enamelling is likely to prove a more satisfactory finish than staining and varnishing. Thus one can give the table two coats of white paint and paint the strips and edges a dark green, finishing with a coat of clear varnish. The resulting table will look well and bear no outward sign of its humble origin.

TABLE, CONTINENTAL (TRESTLE-TYPE DESIGN)

Fig. A shows a table of the trestle-type design which is familiar in the peasant homes of Central Europe. It looks well made in oak, or it may be made in white wood and painted a bright, tasteful colour such as the peasants themselves like to use.

It is made on the trestle principle. A long, narrow top is supported by four carved legs. Underneath these, four cross-pieces are fitted,

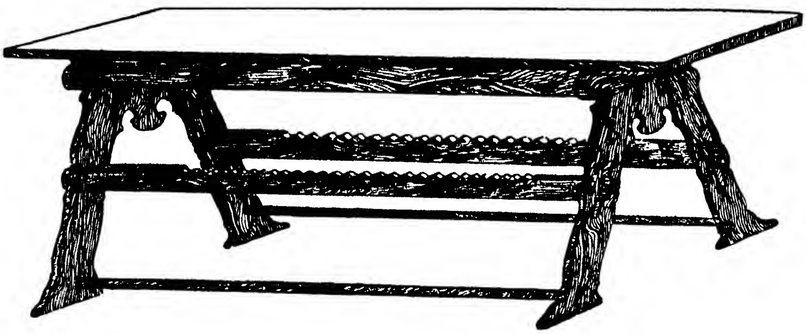


Fig. A.—Continental Trestle-type Table.

two of them being kept in position by means of four wooden pegs, as shown, fitted at the sides of the table.

The pieces required for making the table are :

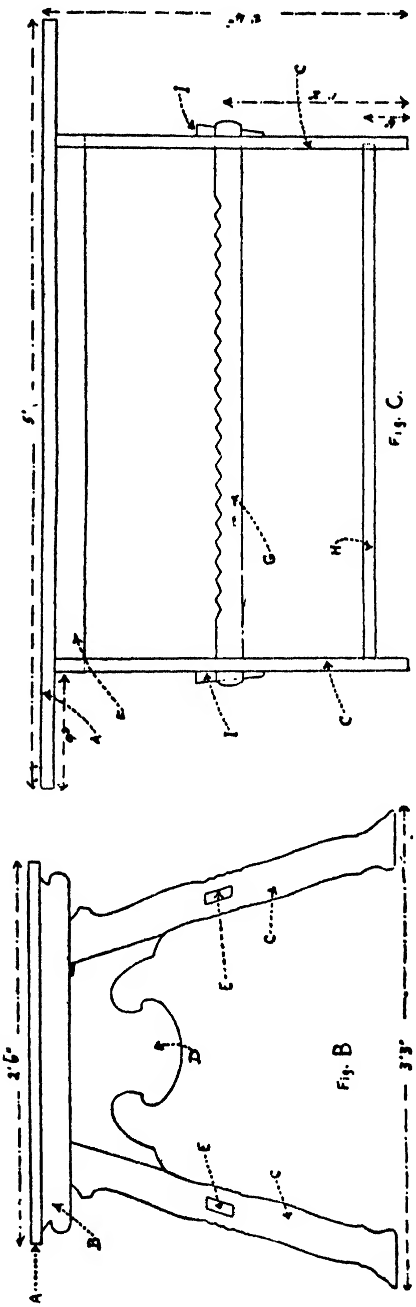
Top (1). Middle cross-pieces (2). Legs (4). Bottom cross-pieces (2). Carved end pieces (2). End plinth pieces (2). Front and back end pieces (2).

The measurements given can be used as a guide, and the reader can modify them as he wishes. Fig B shows a plan of the end of the table. The top A is 2 ft. 6 in. wide, and rests upon the end plinth B, which is not quite so long as the table is wide. The top is 1¼ in. to 1½ in. thick. The plinth is 1½ in. thick to about 3 to 4 in. wide.

The legs CC are about 3 in. to 4 in. wide, and they should be cut out to the shape shown by means of a keyhole saw. They are 1½ in. thick. The tops of the legs are tenoned into the plinth B, ordinary mortise and tenon joints being used. D is a piece of wood 1½ in. thick cut out to the shape shown and tenoned into the legs and into the plinth. Before these are cut out, paper patterns should be made of the specific design, and these

should be used to mark out the legs and cross-pieces for cutting. The mortise E should be cut in the legs about half-way down to accommodate the cross-pieces G. These mortises go through the whole thickness of the wood. When selecting the wood for the legs and carved cross-pieces freedom from knots and straightness of grain are the characteristics to choose.

Fig. C shows the front section of the table. The top is 5 ft. long. An overhang of 9 in. is allowed between the ends of the table and the outside surface of the legs. The plinth F is tenoned into the legs, and is the same thickness as the plinth B. The cross-piece G is $1\frac{1}{2}$ in. thick and $2\frac{1}{2}$ in. wide, and goes through the mortised holes made in the legs. It is kept in position by two wooden pins II, which give it a decorative appearance The cross-piece H is round in section, and measures about $1\frac{1}{4}$ in. in diameter. It is tenoned into the legs, the mortise goes half-way through the thickness of the legs. The cross-pieces GG should be serrated with a tenon saw as shown.



Dimensions and Details of Trestle-type Table.

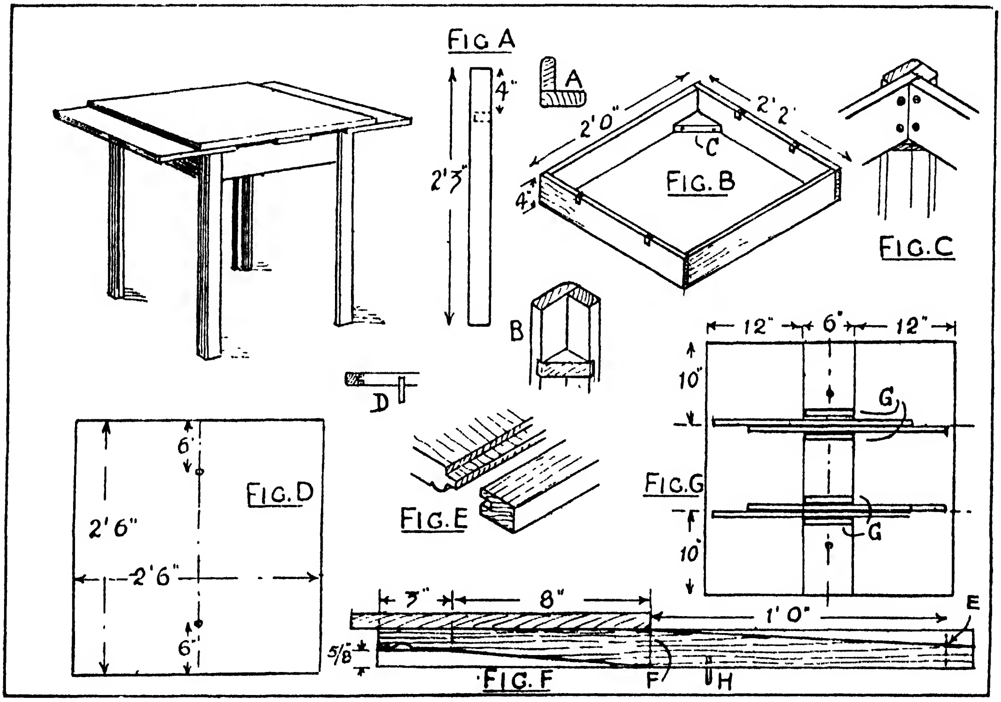
TABLE, EXTENDING TYPE

This is a popular type of table, well worth making if sufficient wood can be got for the purpose. No turned legs are required, and only a few lengths of matchboarding for the top and leaves. The work is remarkably simple, no difficult joints being involved.

First construct the legs. These are made up of two pieces of $\frac{5}{8}$ in. deal for each leg, cut to the length given in Fig. A. One piece is $2\frac{1}{2}$ in. wide, the other $1\frac{7}{8}$ in., so that when they are joined together L shape, both faces of the leg will be alike. At 4 in. from the top of each piece chisel out a $\frac{1}{8}$ in. deep groove across to receive a right-angled piece of wood on which the frame of the table will subsequently rest. Note that these grooves are

cut right across the narrow piece of the leg, but stopped to ½ in. from the edge of the wide piece so that the groove will not show on the face side when the pieces are together.

Join with glue and nails, punch the nails well down and round off all the edges on the face side, as in A. Cut four triangular pieces of wood and glue them in the grooves, as at B. The frame of the table, Fig. B, is made very simply of ⅝ in. by 4 in. wood, butt jointed together with glue and nails. It is essential this should be square at the corners, so in each angle screw a wood bracket, as at C. Now screw the frame to the legs, as



Extending Type of Table.

in Fig. C, strongly. Remove the corner brackets when screwing- -they will be in the way, but replace them directly afterwards.

The table top, Fig. D, is made up of the ⅝ in. thick matchboarding mentioned. Cut enough pieces to make up the length, but as these are to be clamped each side to prevent warping, as in Fig. E, make an allowance for the clamps when cutting.

The clamps are 1½ in. pieces of the matchboarding, cut with the grooves included. The boards for the table top will then be 2 ft. 3 in. long, plus enough for the tongues, which with the clamps will make up the width of 2 ft. 6 in. required. Glue them together and clamp up. When dry, cut a tongue along each edge to fit the grooves in the clamps and glue the latter on. The beaded edges of the boarding will be the under side of the table top.

Turn the top over and run a pencil line across the centre, On this and at the distance shown bore ¼ in. holes nearly through the wood. In these holes glue 1½ in. pieces of round rod, to leave two pins sticking out underneath the top, as at D.

A second top must now be made in a similar manner, but the length should be at least ¼ in. longer to allow for waste in cutting as this top is to be sawn into three pieces, a centre piece and the two extending leaves. When made up, saw into three, the leaves being 12 in. wide each and the centre piece 6 in. wide. Plane to these measurements. Run a line down the middle of the centre piece, and on this bore ¼ in. holes through to correspond with the pins of the table top. File these holes to an easy fit for the pins.

The rising runners, Fig. F, are lengths of ¾ in. by 1½ in. wood, 2 ft. long. These, when cut and finished, are screwed, a pair to each leaf of the table. From one end measure off 11 in. and draw a line across (F) and square it down the sides. From the same end make a straight saw-cut 3 in. long and ⅝ in. up, then level off from this to the line F. The straight 3 in. at the end is shaped up a little, as shown, to provide a grip for the fingers.

From line F (which by the way denotes where the leaf will come afterwards, a leaf being shown in position in Fig. F), measure off 12 in. and from this draw a second line across and down the side. On this mark a point E, ⅝ in. from the top. A line from F to point E, extended to the end of the runner, denotes the required slope. Saw and plane to this slope. Four of these runners will be required.

Lay the table centre and leaves together, upside down, on the bench, and from a distance of 10 in. each side draw pencil lines across the three, as in plan, Fig. G. Touching these lines, fix the runners to the leaves, a pair to each. Note these runners are side by side and are 1 in. short of the outer edges of the leaves to which they are attached, or in other words, the leaves come level with line F on the runners.

Cut four pieces of 1 in. square wood 6 in. long and screw these to the centre piece and each side of the runners, as at G, to keep them in place as they slide out or in. Take this centre piece and fix it across the frame with screws, exactly in the middle. Place the leaves in position each side and where the runners rest on the ends of the frame mark and cut out notches in which they can sink in level, so that the leaves will rest flat on the frame. Place the top over and test the action, by withdrawing the leaves. Finally, to prevent the leaves being drawn out too far drive in a nail, as at H in each runner. Stain and varnish the table oak colour.

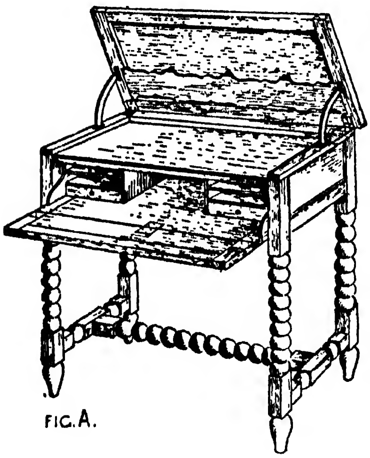
TABLE, FOR WRITING OR TYPEWRITING

The design illustrated at Fig. A forms, when closed, an ordinary table quite flat on the top, but when the top is lifted up provides a writing-desk, and when the front is pulled out allows of the typewriter to be used with easy access to paper and stationery.

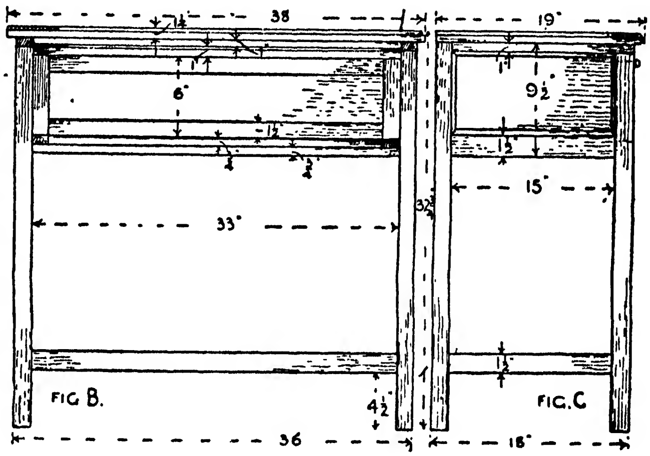
The main dimensions are given in the front and side views at Figs. B

and C. The total height of the table is 2 ft. 8¾ in., the writing surface is 2 ft. 6½ in., and the level of the typewriter shelf is just under 2 ft. high, thus allowing sufficient knee-room underneath. The construction is as simple as possible consistent with strength, alternative methods of dealing with the legs being suggested.

The Framework.—The construction of the framework is shown at Fig. D and applied with either the plain legs shown in Figs. B and C, or the turned legs in Fig. A. Prepare the four legs 1½ in. in section to a length of 32 in. to begin with, marking the back ones A to 31½ in. and the front ones B to 31 in. The top rails C at each end are 1½ in. by 1 in. and 17⅛ in. finished length; the back ends have a dovetail ⅝ in. long, as indicated in the detail at Fig. E, and fit in the top of the back legs. The front legs are dovetailed in the front ends of the rails as shown in Fig. D, also in



The Completed Table.

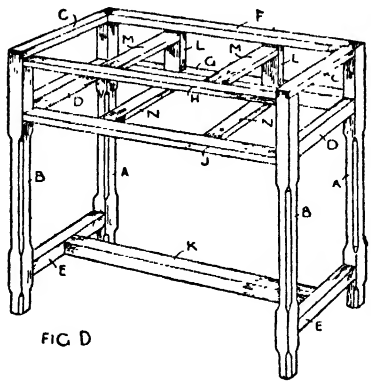


Front and Side Views of Table.

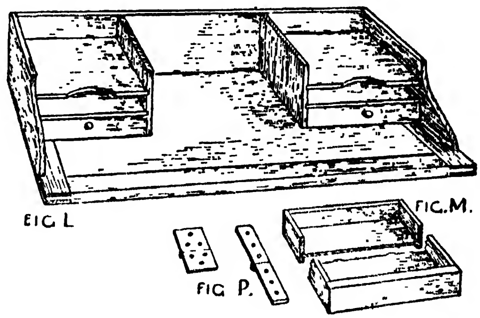
the enlarged detail at Fig. F. The side rails at D and E are 15 in. between the shoulders with a tenon length of ¾ in. for the rails at D and 1 in. at E. When fitted together the two end frames should be exactly the same height and width.

Joining the end frames are two rails at the back and front and one at the bottom. The top one at the back is 33 in. between the shoulders, and a ⅝ in. long dovetail at each end as at F; it is 1½ in. by 1 in. in section. The next rail G is 1½ in. in section, 33 in. between the shoulders with ¾ in. long tenons, and is fitted 8 in. from the top of the rail C. The top front rail H is 1½ in. by ¾ in., 33 in. between the shoulders with a barefaced tenon 1 in. long, 1 in. wide, and ½ in. thick. The top of the rail is fitted ¼ in. down from the shoulder of the front legs B; the next rail J is the same in size but the tenons should be ¾ in. long, and it is level with the rails at D on the bottom edge. The connecting rail K, joining the rails E, is 1 in. in section, 33 in. between the shoulders with tenons 1 in. long.

Connecting the back rails F and G are two uprights L; these are 1½ in. wide, 1 in. thick, and 7 in. between the shoulders, the tenons being ½ in. long. These uprights are fitted so that the centres are 9½ in. from the legs A. Two rails M are now fitted between the uprights L and the front rail at H; they are 15 in. between the shoulders with tenons ½ in. long, and it will be seen that the top of the rails will come ¼ in. below the shoulders of the uprights L to enable them to be level with the rail H. Similar rails are now fitted at N flush with the bottom of the rail G. Before the framework is glued together, the top board of ¼ in. oak-faced plywood should be prepared. This board, as shown in the enlarged detail at Fig. G, is fitted under the rails C and F and rests on the rails J and N, portions being cut



Framework of Table.

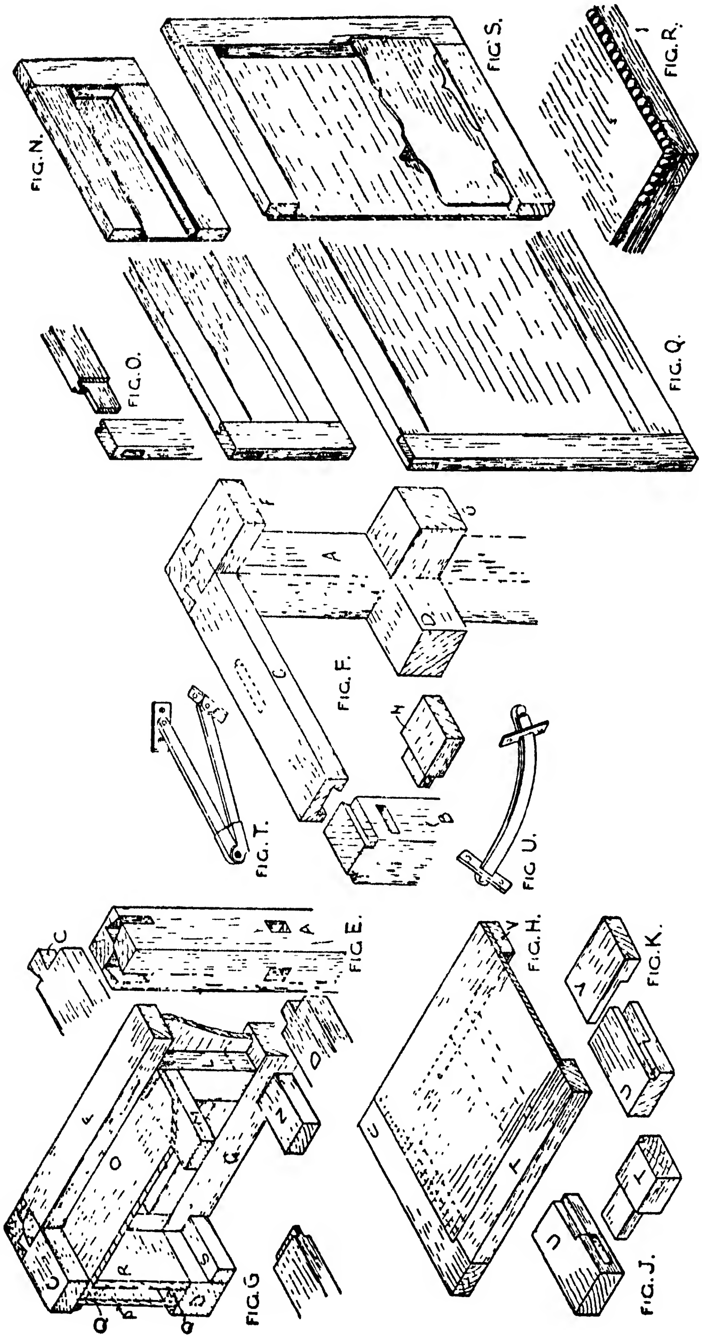


The Typewriter Shelf.

out to allow for the legs and the uprights at L. It is afterwards screwed to the top rails.

The Panelling.—The panelling at the ends P is of oak-faced plywood ¼ in. thick, back on to fillets of ¾ in. section as at Q. The front is finished off with suitable beading ¼ in. wide. The inside of the ends is made flush with plywood as at R. The back is also filled in with plywood, oak-faced back against fillets 1 in. by ¾ in. To complete the lower carcase, screw on fillets ¾ in. in section against the rails D, between the rails G and J as at S.

Typewriter Shelf.–The sliding shelf to hold the typewriter is shown at Fig. H. It is 33 in. long and 15¾ in. wide. The front rail T and the end rails U are 1½ in. by ¾ in., the back rail V being 1½ in. by ½ in. The board is fitted in rabbets of ¼ in.; as indicated, the joints at the corners may be halved, but the mortise and tenon joints at Figs. J and K for front and back respectively are better. The fittings for the top of the slide are shown at Fig. L; the shelves are of ¼ in. thick plywood, with other shelves at each end 6 in. wide. This part of the work is quite simple and needs no special instruction. The drawers are made with ½ in. thick fronts and ¼ in. sides and back, the bottoms being of ⅛ in. material, fitted in



Constructional Details of Combination Table.

grooves as indicated at Fig. M. Care should be taken to make the top of the shelves 6 in. to fit closely in the space provided; if they are less than the space, the slide will not be firm when the machine is in use.

The front of the slide is shown at Fig. N and consists of a framework of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. wood joined at the corners with mortise and tenon joint as at Fig. O, and filled with a plywood panel let into a $\frac{1}{4}$ in. rabbet as indicated in the section. Suitable beading is fitted in front. The total length is 33 in. and the width 6 in. Suitable hinges of the back-flap type are shown at Fig. P. It should be noted that the above dimensions are approximate; the exact measurements of spaces to be filled should be measured; slight deviations, owing to planing and fitting, are unavoidable and should be allowed for.

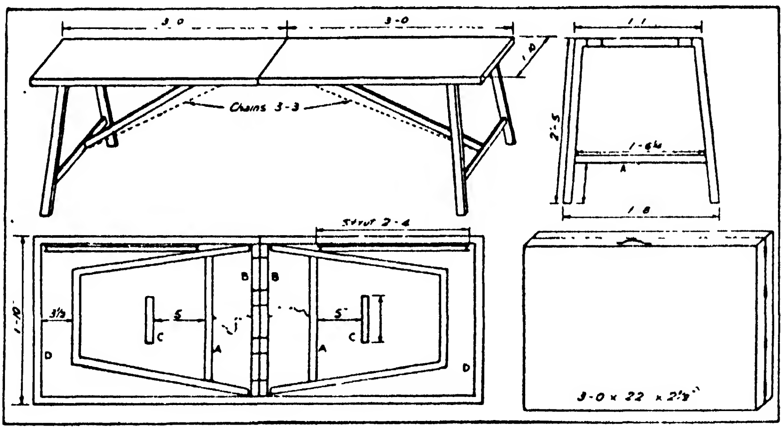
The Table Top.—The top of the table is framed up from $1\frac{1}{2}$ in. by 1 in. wood, to a length of 38 in. and a width of 19 in., either the lapped halving

as shown at Fig. Q or the mortise and tenon joint being used. The top is covered with oak-faced plywood, cut $\frac{1}{4}$ in. each way smaller, glued and bradded on and the rabbet filled in with ball beading as indicated at Fig. R. The rack for notepaper, envelopes, etc., as indicated at Fig. S, is cut from $\frac{3}{16}$ in. or $\frac{1}{8}$ in. plywood. The ends are let into the end rails, and strips of $\frac{1}{4}$ in. thick wood used at partitions. Ordinary butt hinges can be used to attach the lid, but it will be necessary to fit stays to keep the top up, when the table is being used as a writing-desk. Two forms are suitable, either the desk stay at Fig. T, or the quadrant, fitted with spring, as at Fig. U. The latter will fit through the centre of the top side rails and will run in the space between the panelling.

The wood can be finished with linseed oil, but a quicker method is to use a good wax polish. By applying an ammonia solution to the wood before the wax is applied, the oak can be darkened.

TABLE, PAPERHANGER'S

The portable table illustrated was designed by a paperhanger for use on long journeys. When folded it can be carried in comfort, takes no



Folding Table for Paperhanging purposes.

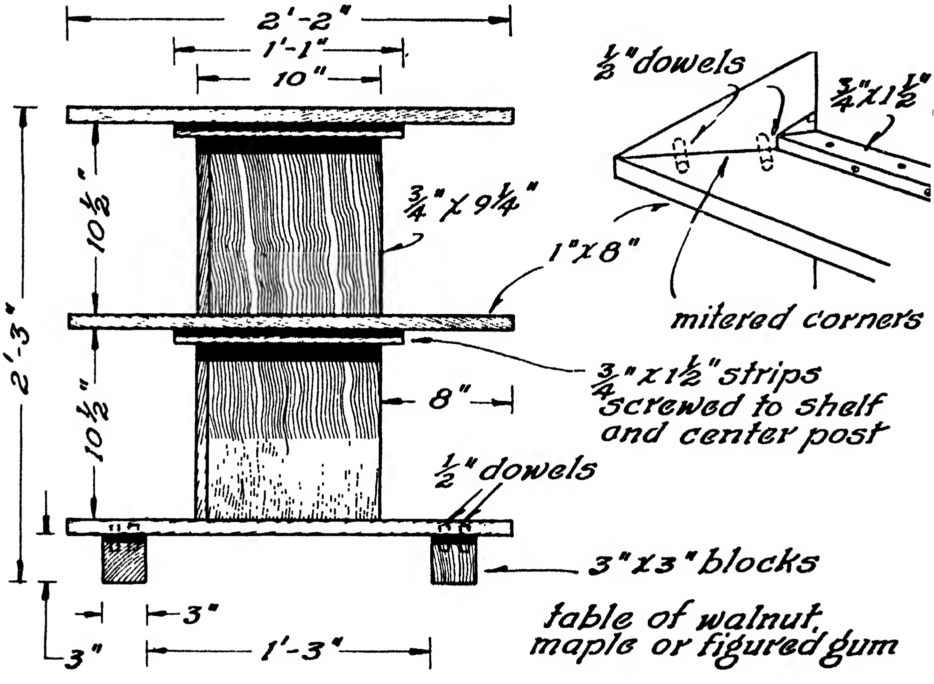
longer to fix up than the old method, and is better to work with, being more rigid. Its cost is a trifle more than ordinary boards and trestles. Six rolls of paper can be carried inside it.

Materials wanted are: 2 pieces of $\frac{1}{4}$ in. three-ply, 3 ft. by 1 ft. 10 in.; all other wood is 1 in. square. It is mortised in the ordinary way. Make the framework 3 ft. by 22 in., fix ply on top (nail or screw). Fix butts on as per diagram, using 3 in. by $\frac{5}{8}$ in. brass butts. Next make trestle legs 2 ft. 5 in., 1 ft. 1 in. at top and 1 ft. 8 in. at bottom, the cross-piece being 1 ft. $6\frac{1}{4}$ in. and $6\frac{1}{2}$ in. from bottom of leg. Two butts, 2 in. by $\frac{5}{8}$ in., are fixed at top, but lie underneath framework. One side of butt is screwed, the other lying against the ply is bolted with countersunk set-screws, care

being taken to let butt in far enough to allow for nuts, unless rivets are used. A small chain 3 ft. 3 in. long is fixed at bottom of A to the inside of B with ¾ in. screws and washers. A piece of 1 in. square wood 2 in. long is screwed 5 in. from A on to ply, to allow strut to support the middle weight, the strut being cut out at top and bottom to fit on A and C. These are not fixtures, as they lie in by the side of trestles. Top of trestle is 3½ in. from D, supporting struts 2 ft. 4 in. long. When finished the table is glass-papered and a coat of priming put on, stopped, and two coats of Venetian red; then dusted with whiting to stop sissing and grained with Vandyke in water, left to dry and varnished, giving a mahogany finish. A handle is fixed as shown.

TABLE, TIER OR COFFEE

This trim, modern table will look well in walnut, maple or oak. A full 1 in. stock, or close to it, is used for the middle shelf, top and bottom



A TIER TABLE in WALNUT

sections, which are both glued up. Three-quarters stock is used for the centre post, boards ¾ in. thick and 9¼ in. wide being assembled with finishing nails or ¼ in. dowels to form the centre of the table, 10 in.

square. Strips $\frac{3}{4}$ in. thick and $1\frac{1}{2}$ in. wide are mitred at the corners and attached to the under side of the top and centre pieces, screws being used to attach the shelf and top to the centre post. The shelf consists of boards 1 in. thick, 8 in. wide and 26 in. long, mitred at the corners and joined and glued together with $\frac{1}{2}$ in. dowels as shown. The bottom shelf is fastened to the lower end of the centre post from the under side with countersunk screws. The four blocks, 3 in. square, are attached to the corners of the lower shelf $2\frac{1}{2}$ in. from the edge. Use two $\frac{1}{2}$ in. dowels glued in holes bored in the under side of the lower shelf and block, in assembling the blocks. These will raise the top of the table to a height of about 27 in. If small finishing nails, covered with putty, are used in assembling the centre post boards, they will hardly be detected in the finished stand. Maple can be finished with clear lacquer or in red Colonial finish. Walnut should be given a filler coat, well rubbed in, and finished with polished wax or clear lacquer. Oak should either be limed or wax-finished.

TABLE LAMP

The lamp illustrated is easy to make and, incidentally, is quite inexpensive. All parts can be cut from a planed board of $\frac{1}{2}$ in. fretwood, 13 in. long and 6 in. wide.

How to mark out the parts is clearly shown in Fig. A, where the board is divided into $\frac{1}{2}$ in. squares. Cut out with a fretsaw and smooth the edges with a file and glass-paper. Piece 1 is cut out as a whole, the shaded strip in the centre being ignored for the moment.

In the baseboard (4) cut out the $\frac{1}{2}$ in. sq. mortise slots to suit the tenons in piece 1, and in the centre bore a $\frac{3}{8}$ in. hole. Bore a similar hole in the centre of the cap (5) and slightly round off the outside edges. Fit piece 1 in the baseboard, fix the cap on top and drive in each side of the hole a thin screw. Now take apart and cut down the centre of piece 1, to remove the shaded strip. Piece 1 is now in two parts, glue these in place, glue the cap on and drive the screws home. The space left in the centre is for the flex wire.

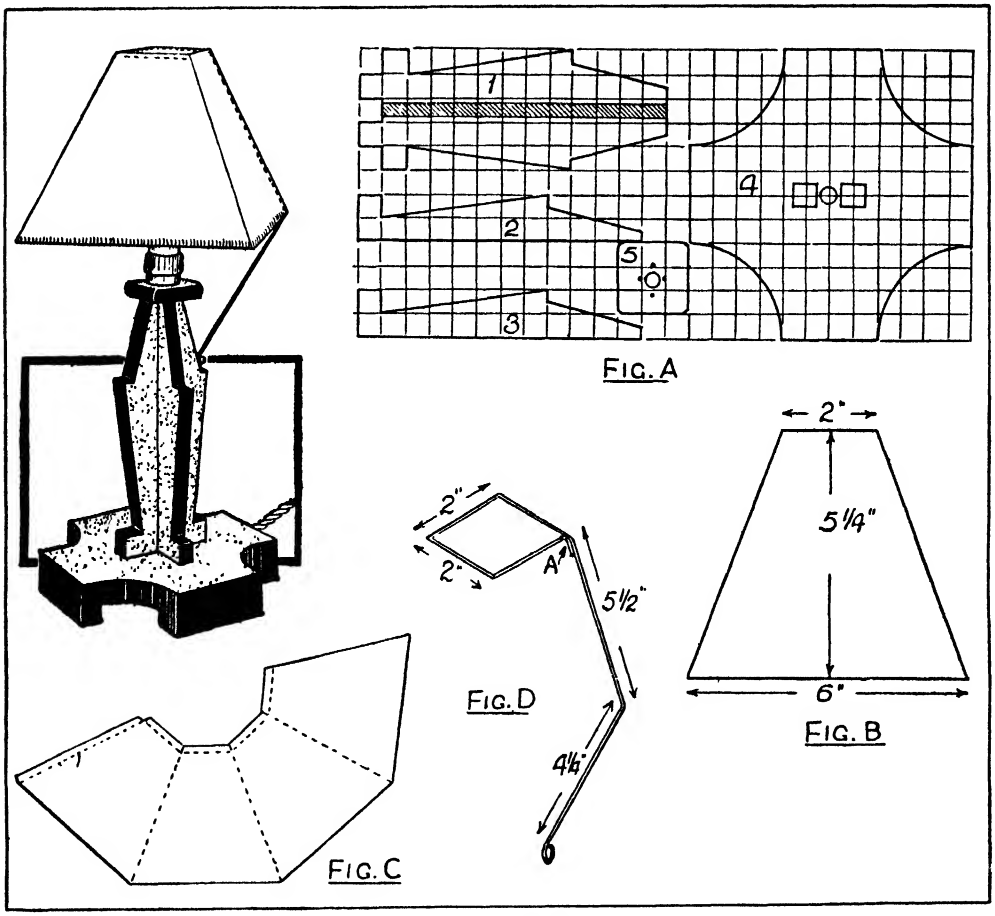
Take pieces 2 and 3 and glue to the side of piece 1. Drive a thin nail through the cap into these and a nail through the bottom part of each into the baseboard. From the waste wood left over cut four pieces $\frac{1}{2}$ in. wide and 2 in. long. Glue one of these to each side of the baseboard, underneath, to form feet to raise it up a little. In one foot, before gluing, cut a groove $\frac{1}{4}$ in. by $\frac{1}{4}$ in., to provide a hole for the flex to emerge from.

Give the woodwork a good glass-papering until quite smooth, and if intended to match the furniture of the room stain the wood to the desired colour and either varnish or polish. If a brighter appearance is preferred give the stand two coats of enamel. A better effect is obtained if the enamel is put on in two colours, say pale blue or green with dark blue or green for the edges.

Obtain a length of flex of suitable length and a lamp holder and plug.

All can be bought at any electrical stores. Draw the flex through the hole in the foot and up the centre of the stand. Connect the lamp holder to it and screw the latter to the cap. At the free end of the flex fit the plug for connecting to the light point.

To make the shade, first cut a template to the pattern given in Fig. B, and cut out in stiff paper or cardboard. Lay this on a piece of parchment



A Novel Design of Table Lamp.

Fig. A.—Pattern for Parts. Fig. B.—Pattern for Shade. Fig. C.—Complete Shade, ready to bend. Fig. D.—Wire Support.

paper and mark out the pattern for the shade, as shown in Fig. C. Allow a strip $\frac{3}{8}$ in. wide at the top for fixing to the wire support and a strip at one side for stitching together. Bend the shade at the dotted lines and stitch to form the shape. Stiffen the bottom edge with a binding of paper tape or ribbon.

For the wire support, get about 2 ft. of stout brass wire. Bend to shape, as seen in Fig. D, and at the bottom twist to form a ring, just

large enough to pass over the shank of a stout ½ in. round-headed brass screw. Fix the square at the top with a touch of solder at A.

Place the shade over the square of wire at the top of the support, bend the strips over, and stitch round. Now fix the support with the round-headed screw to the stand at approximately the position shown and bend the wire, if necessary, until the shade is central.

TABLE REPAIRING

Within the compass of a short article it is not possible to deal with every type of casualty in connection with tables that is likely to be sent for treatment to a workshop, but it may be useful to take a few familiar types and consider methods, effective and rapid, of dealing with troubles most frequently met with. Of tables there is an endless variety of styles and sizes, some more ornamental than useful on account of their frailty, but the dining-table (which is an article in daily use, and is often subjected to not too considerate treatment), if well made, whether the design is of the screw-extension type, the gate-leg, the draw-leaf, or the Pembroke, should be good for many years' service without showing serious weakness, if damage by accident is ruled out.

Many of the choice specimens of eighteenth-century work in show-tables or escritoires, when needing repair or restoration, call for special care and experience. It may mean replacement of parts, matching of old inlays, or the repair and refitting of drawers.

Draw-leaf Tables.—Of all tables yet designed, and capable of extension as to length, the draw-leaf table would seem the soundest and least liable to get out of order. With leaves that are framed, and especially when the legs have underframed rails, if the material and workmanship are good the length of service they promise is not easy to conjecture. We have seen one over 250 years old and it seemed good for another century or more. And yet these tables had to give place in Victorian times to the type known as the telescope dining-table, having one or more leaves.

The troubles that arise from this kind of table are due to the screw not drawing evenly, the slides sometimes stick and require jarring to make them slide at all. A damp atmosphere may have caused the tongue to swell or the tongue has worn rough. A little blacklead or dry soap rubbed into the groove will often remedy the matter, but the cause is frequently due to the screw being bent or not having been fixed centrally.

The remedy should be to refix the screw so that it will draw without bending. The plate that is screwed to the end framing rail is sometimes wrenched loose by overwinding, and larger screws should be inserted and the plate shifted so that the screws enter new wood. Sometimes the extension screw is so strained that the framing rail is broken, as illustrated in Fig. A. In such a case a new rail must be substituted. No battening of the broken rail is of any use. A new rail is easily inserted if that portion of the table is drawn out and the top taken off. In a good table of this kind where

the top is of hard wood the risk of warping (Fig. B) of the top or leaves is slight, but where white wood, strained, forms the top and leaves they sometimes curl. The remedy is to cut through the top or leaf at the portion most curled and to rejoint and batten afterward, planing down level and staining. The cause of this curling is often that the top surface is stained

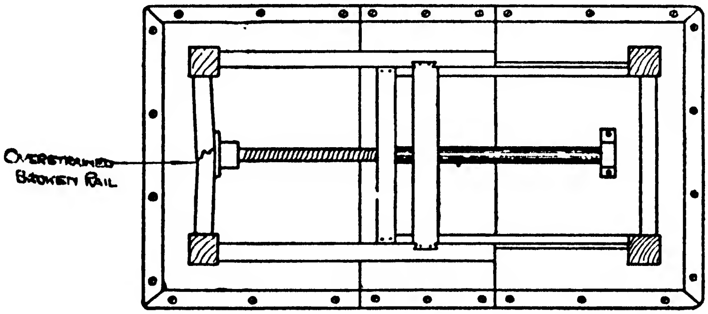


Fig. A.—Repairing a Broken Framing Rail.

and filled while the under side is open grain. This should be coated with a shellac varnish, so that dampness from the atmosphere cannot enter and swell the wood.

If the framing is loose, remove the top, knock slightly apart and reglue and cramp up, pin the tenons, and glue a sensible-sized block at the corners of the end framed rails. The legs are usually too stout to break readily, but when this happens a new leg is the only remedy. When the

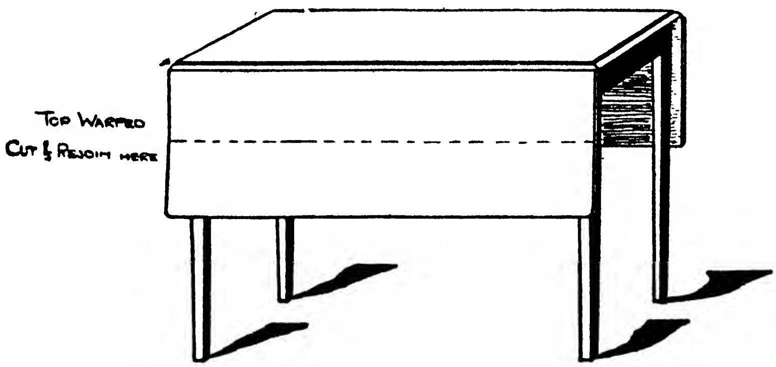


Fig. B.—Repairing a Warped Top.

amount of leverage is considered to which these legs are subjected, to attempt to patch up a broken leg is sheer waste of time. If socket castors work loose, glue a piece of canvas round the pin, knock castor on tightly and fix screws in fresh positions. The pin of a ring castor broken off in the leg can be removed with a screwdriver if a kerf is cut first in the end of the pin with a hacksaw.

Many of these defects are met with in all kinds of tables and the suggested method of repair would be equally applicable.

Gate-leg Tables.—The gate-leg table is a popular type that often comes up for repair. A plan of the under side of the top of the gate-leg table is shown in Fig. C. Sometimes very old specimens with tops of English oak that have split or warped come in for repair. It is chiefly a case of cutting and rejointing the top and reframing portions of the frame that is required. A well-made gate-leg table of seasoned wood, and if quartered oak is used for the top, should stand many years without showing any weakness. But before the war, and since, the manufacture of this type of table of a low grade and price has been carried on to an enormous extent. We have seen them with no pretence to a sound joint anywhere, one dowel serving to connect up the lower framing, and not more than two anywhere. The top of plain oak will have gone all shapes, and the frame is in a very little while about as rigid as a concertina. The only thing to do with these is to knock them all apart, make good the joints and have at least two good dowels everywhere, while the tops will need rejointing and battening underneath. These battens should be placed as shown in Fig. C, thus forming a stop for the gate-leg and not fouling the radius which it must describe in opening. Often these cheap tables have square joints instead of rule joints on the top. Of course, a rule joint is superior, as it holds the surface of the top level when raised and is ornamental when the leaves of the oval are lowered. This joint is easily made with a $\frac{5}{8}$ in. hollow and round plane in a top $\frac{7}{8}$ in. in thickness. There is just one principle to be observed in fixing the back-flap hinge, and this is illustrated (Fig. D). The pipe of the hinge must be immediately beneath the joint as it appears on the top. On the under side the pipe is sunk slightly, and the flaps have an upward tilt at each end when fitted.

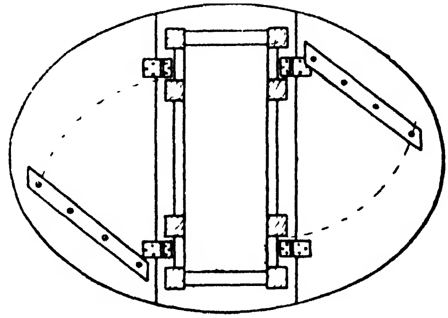


Fig. C.—Plan of Oval Top to Gate-leg Table.

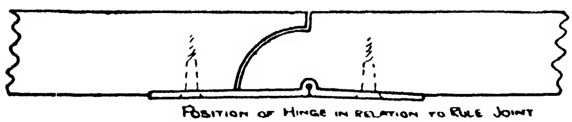


Fig. D.—Showing Hinge Position.

Pembroke Tables.—The Pembroke table, many of which can be met with at sales up and down the country, is an old favourite. Invariably in Spanish mahogany as hard as iron, it is often found that an injudicious passion for cleanliness has almost ruined them. The tops with constant scrubbing are sometimes bleached almost white. The defects with these are chiefly warped tops, rule joints damaged and broken where hinges have rusted away, or framing worked loose. The remedy in each case

is obvious, and has been already explained. Where the rule joint is damaged severely the best plan is to slightly reduce the width of the leaf by planing the old joint and cutting the hollow of the rule joint afresh rather than stick on new pieces which would always be a source of weakness.

Those little mahogany tables with a central pillar, three Queen Anne club-shaped trusses, and a circular top can often be bought cheaply, and are worth restoration. A truss that is broken can often be reglued and screwed or a piece sliced on. A metal plate at the base of the pillar with three flanges that reach over the trusses, and are screwed to them, is a good reinforcement. A typical example of an old mahogany table repair is shown in the plate facing this page.

Relining a Writing-table.—There is one problem that frequently presents itself, and to the amateur seems difficult of solution, and that is the relining of a writing-table. In London or any big city it is easy to send the top to be relined by a table liner. But the job has to be done sometimes far removed from such expert assistance. An easy and very artistic method of dealing with this matter, whether the lining is to be done in skiver, rexine, or fabric, is as follows :

Remove the old lining. Tooth down the surface with a toothing plane or the edge of a rasp. Make good any defects in the veneers surrounding the space to be lined, and then cut with a plough, or a scratch tool, a groove $\frac{3}{8}$ in. deep and $\frac{1}{4}$ in. wide all round the table, where the lined surface meets the veneer surround.

Prepare strips of beading of oak, mahogany, or whatever wood matches the table, which will fit easily these grooves, and mitre them at the corners. Next cut the cloth to the size required, so that it will drop into these grooves. Glue over the surface to be lined, place the cloth in position and, working from the centre outward with a broad veneering hammer, squeeze out glue and level the cloth perfectly, so that no creases remain. Next trim the edges of the cloth so that it overhangs the trench $\frac{1}{4}$ in. all round. Now knock in the beads so that they will clip and hold the edge of the lining tightly all round. The beading should be polished previously and a flat piece of wood used as a bruising piece. This will be found a very neat way of finishing the lining of a top, and it is impossible for the edges by any chance to curl away from the table.

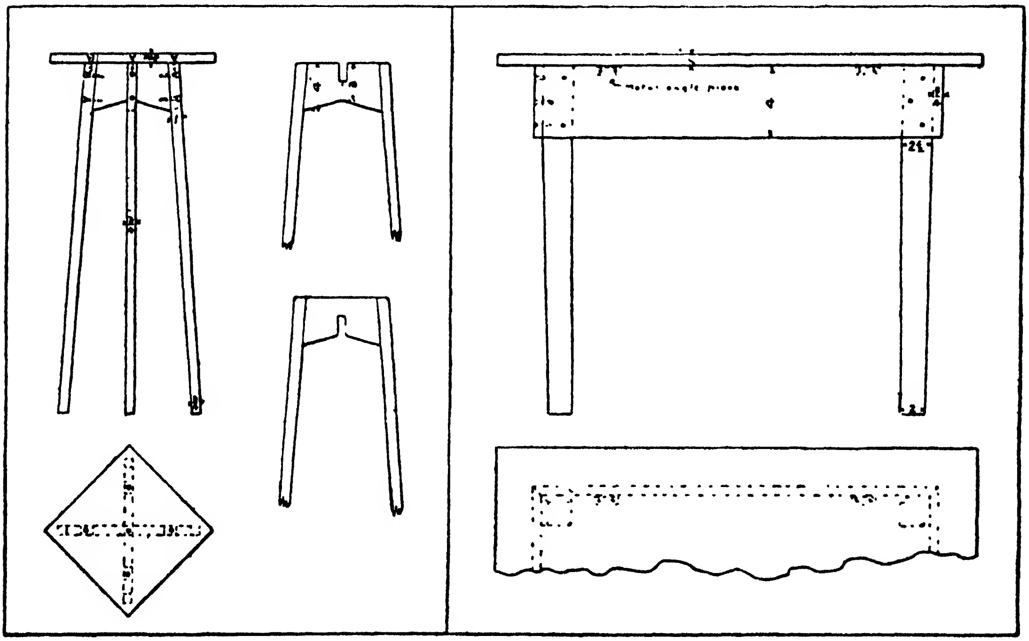
TABLES, EASILY CONSTRUCTED

Tables of the common or household variety are as a rule rather avoided by the amateur joiner. This is probably due to the fact that, as usually made, they entail mortise joints which, to make well, present some little difficulty to the amateur. It may be mentioned, however, that strong and eminently satisfactory tables can be made without anything beyond well-made screwed and glued joints.

Small Tables.—Small tables up to about 30 in. square, or equivalent in oblong shape, may be made, with diagonal frames, as illustrated, and

are particularly convenient to sit at, having no side pieces to chafe one's knees. The figures almost explain themselves, the cross-frames to which the legs are screwed being halved into one another and the top screwed down to the legs and cross-frame. All screws' heads should be well countersunk with a $\frac{3}{8}$ in. bit, and the holes plugged with wood plugs or vulcanite or coloured ivory substitute such as dealers in wireless accessories stock. This adds to rather than detracts from the appearance of the tables.

The main points are to make really well-fitting joints, use good freshly made glue, and make the holes for the screws fit the screws they are intended for.



Examples of readily-made Domestic Tables.

Actual dimensions are not given, since tables vary so much in size and shape, but $\frac{3}{4}$ in. thickness throughout is sufficient for tables up to, say, 20 in. square, and $\frac{3}{4}$ in. for the tops and 1 in. for the frames and legs of larger sizes.

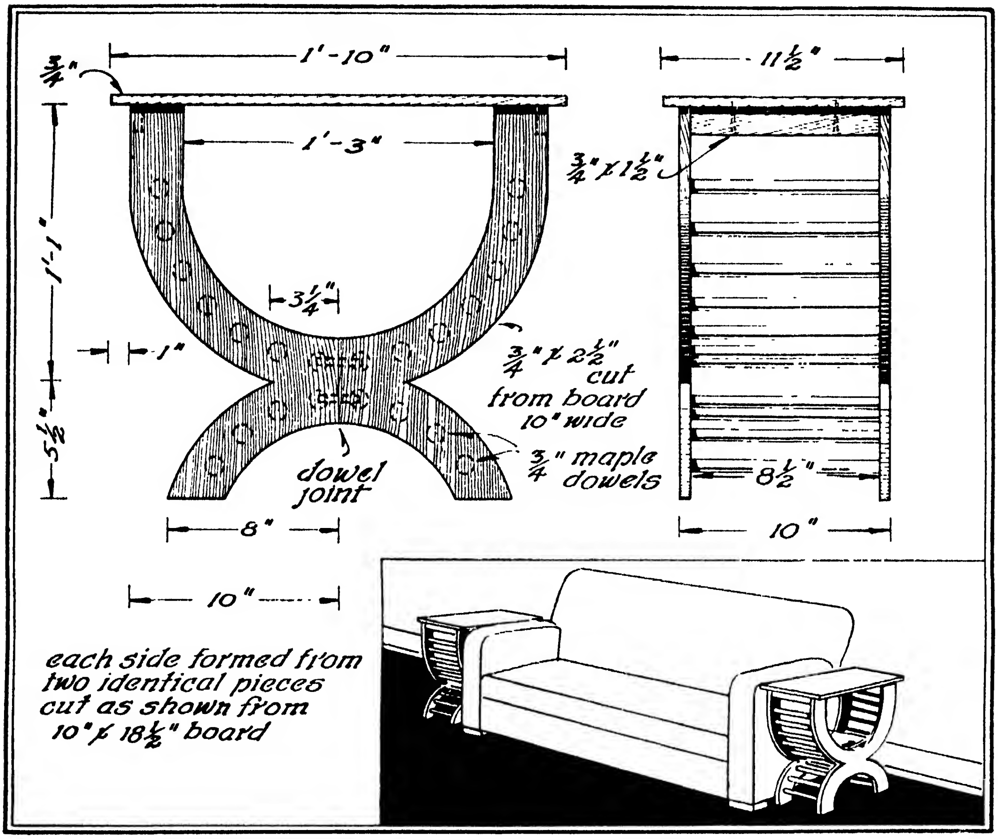
Kitchen Tables.—Kitchen tables, or such as do not matter much as regards appearance, can be made quite strongly by simply screwing and gluing the side and end pieces of the rectangular frame outside the legs, as shown. The tops may be secured by means of metal angle pieces screwed beneath the table, if this is preferred to screwing through the top as before described.

Here again overall dimensions can be settled by individual requirements, but 1 in. timber for the top and $\frac{3}{4}$ in. for the side frame members

is sufficient for quite a large table, and 2½ in. or 3 in. square for the legs. A taper of ½ in. or ¾ in. towards the floor gives a better appearance to the legs.

TABLES, ROMAN CHAIR-END

Each of the sides of these attractive end tables is made from identical pieces of walnut or pinewood, cut out two at a time. The pieces are cut



Roman Chair-end Tables.

from ¾ in. stock, the boards measuring 10 in. wide and 18½ in. long. The pieces are then assembled as shown with dowels and glued. When finished, the side frames are 2½ in. wide throughout, 20 in. across the top and 16 in. across the bottom or feet. Three-quarters inch maple dowels are cut in 8½ in. sections, and nailed between the sides as shown, finishing nails being used and the holes filled with putty. Between the sides, at the top, nail two boards, each 1½ in. wide, ¾ in. thick, and 8½ in. long. Use long countersunk screws in fastening the top board to these strips. The top measures 11½ in. wide and 22 in. long. Note that the junction of the upper and lower curves of the sides meet at a point 5½ in. above

the floor. Give walnut a filler coat before finishing with clear lacquer. Pinewood and the maple dowels are finished with clear lacquer and without stain to give the tables a sharply contrasting effect. The dowels provide racks for magazines and papers inside the tables.

TEA TABLE, MOORISH

This useful and artistic table is just the thing for afternoon tea. It is light and the stand can be folded flat, so it is easily portable. Another thing in its favour is the small quantity of wood required to make it. This can be easily judged by the fact that a 2 ft. length of 1 in. deal, 11 in. wide, together with a piece of fretwood, will make the stand.

The parts, comprising the stand, are drawn in Fig. A. Three separate frames are wanted, differing only in the distance apart of the cross-rails. The legs are 1 in. square, the rails 1 in. by $\frac{1}{2}$ in. thick. If the wood, nominally 1 in. thick, should be $\frac{5}{8}$ in. thick when planed, this will not matter as long as the legs are 1 in. wide and the rails $\frac{1}{2}$ in. thick. It will be seen that the rails in frames 2 and 3 are a less distance apart than in frame 1. Fit the rails to the legs with a mortise and tenon joint, as in Fig. B. Do not glue the joints yet, but make them a tight fit to ensure the frames being firm.

The outside faces of the legs are bevelled each side, as in section A.

The panel ornaments, also shown in Fig. B, are cut long enough to reach across the rails, plus a $\frac{1}{4}$ in. for tenons at top and bottom. Each pair will, of course, be different in length, to suit their respective frames. Cut them from fretwood preferably, but they could be cut from thicker and cheaper wood, deal, say $\frac{1}{2}$ in. thick. In the rails cut mortise slots to suit the tenons. Space the ornaments about 1 in. away from the legs.

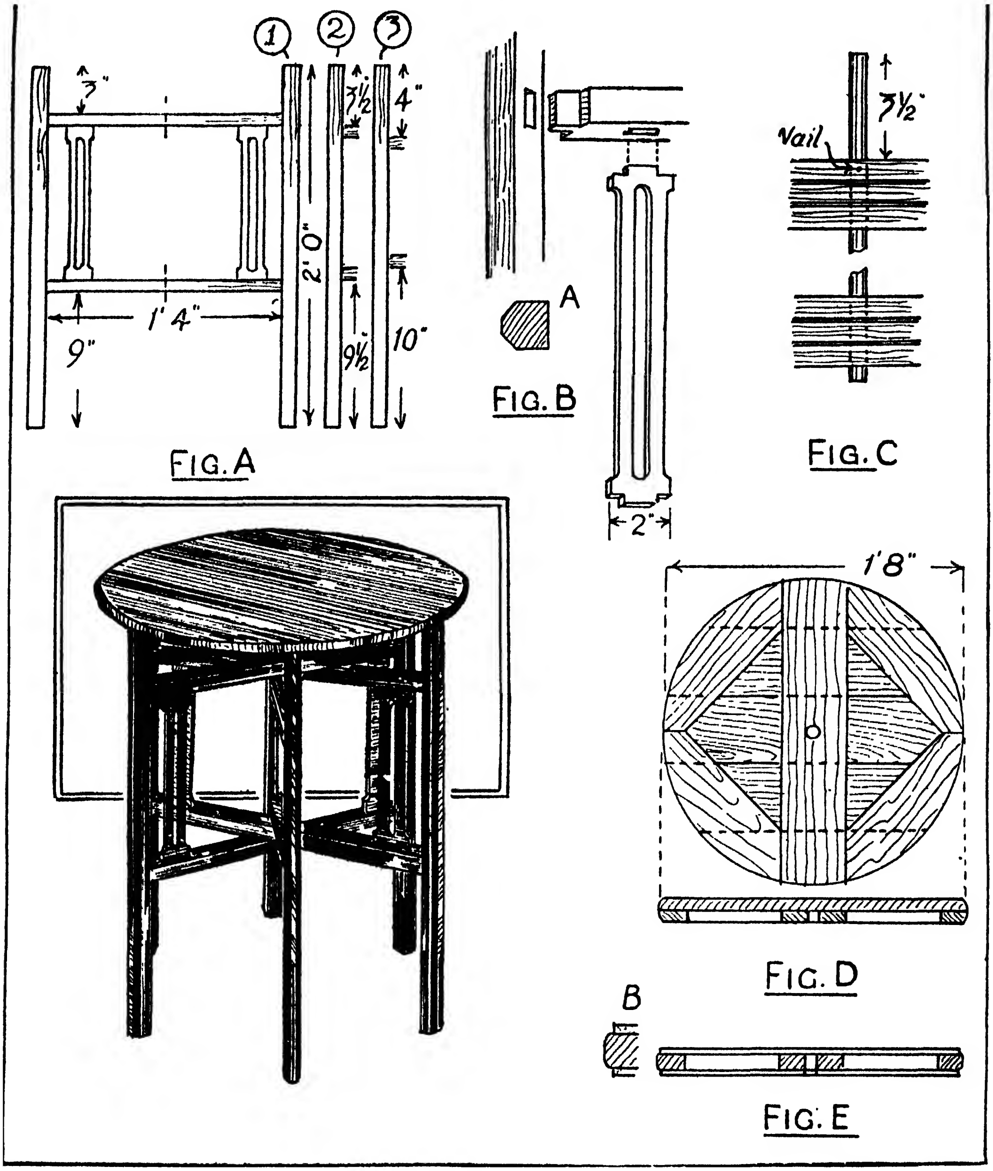
Now take apart, and exactly in the centre of the rails bore $\frac{3}{8}$ in. holes right through. To fit together, first glue the panel ornaments in between the rails, then glue one leg to each frame. Pass the rails of frame 2 between those of frame 1, and glue the opposite leg on. Pass frame 3 between the rails of frame 2 and glue that leg on. Press all joints tight and leave a while for the glue to set.

Get a length of $\frac{3}{8}$ in. dowel rod; that known as curtain rod will be about right. Cut it to a length of 16 in. and push through the holes in the cross-rails, as in Fig. C. Let it stand above the top rail $3\frac{1}{2}$ in., and fix with a small nail where shown. The stand can now be opened out to hexagon shape, or closed up as desired.

Remove all glue, and give the lot a good glass-papering and stain black or dark oak, as preferred. Finish the stand with a coat of clear varnish all over, except those edges of the cross rails which scrape each other when the stand is opened and closed up.

Alternative methods are suggested for making the table top. Fig. D shows what is, perhaps, the easiest and best method. Here the wood used is that known as matchboarding, $\frac{3}{8}$ in. thickness. Glue enough pieces together to make up the width, and when the glue is hard, strike

the circle. This can be cut out with a coarse-bladed fretsaw. In fact, it is the best tool to use for the job, leaving a smoother finish than bow or key-hole saw. The side of the top showing the beaded edges is the



A Moorish Type of Tea Table.

under side, and to this is glued a cross-piece, then side pieces to complete the edging. These are mitred to 45 degrees at the ends to fit together. Glue, and when the glue is hard cut to circular shape to conform with the rest. In the centre of the under side bore a ½ in. hole, ⅝ in. deep.

Round off the edge of the table top with spokeshave and file, and give the whole, especially the top surface, a thorough rubbing with the glass-paper. Finish the table top with black or dark oak stain, and varnish to match the stand. The top is simply laid on the stand, the centre rod, on which the frames swing, entering in the hole to keep it in place.

When wood is scarce, the alternative method of making the top, shown in section Fig. E, can be adopted. Here a frame is made of match-boarding, or even common box wood, like the underframe of the previous top, minus the cross-piece. It is a simple job. Just cut four pieces of the wood to 1 ft. 8 in. long, and not less than 6 in. wide, and mitre at the corners to make a frame. Glue and fit the pieces together on to a sheet of newspaper, and when the glue is set hard, and not before, strike the circle and carefully saw out. Caution must be used when cutting or the joints may be broken.

The upper and lower surfaces of the table top are circles of stiff cardboard, cut $\frac{1}{8}$ in. less all round than the frame. Clean off superfluous glue, leaving the surfaces of the frame quite flat both sides. Then glue one side of the frame, place a cardboard circle on, and turn over. Cut a 4 in. square piece of the same thickness of wood and glue it to the centre of the cardboard. Glue the frame again and place the second cardboard circle on, then leave under pressure for the glue to set.

The sharp edges of the frames are then filed off, leaving the finished edge of the top as in enlarged section B (Fig. E). Give the whole a coat of stain to match the stand, then apply a couple of coats of size to the cardboard, and when this is dry clear varnish the whole.

Bore a $\frac{1}{2}$ in. hole in the centre for the rod to enter, and drop on to the stand. A table top made in this fashion makes quite a satisfactory job, if the joints are well glued. Of course, a stronger job will result if the frame, on which the cardboard is mounted, is dowelled together, but the glued joint should be strong enough for a tea table.

TEA TRAY AND STAND, FOLDING

This tea tray and stand, shown in Fig. A, may be made of any cabinet wood, but oak in a dark finish or gum wood in a medium brown finish will perhaps be most interesting.

Making the Stand.—The sides of the stand are built of two pieces, the supporting piece for the tray and the base. The base is $\frac{7}{8}$ in. thick and is housed to receive the shaped halfit, and the two pieces are screwed from the under side.

The halfits are $\frac{7}{8}$ in. thick, and after they have been shaped up and jointed to the base pieces the joints are prepared for the cross-rails.

The top cross-rail is shaped as shown at Fig. B, while the bottom one, which takes the form of a shelf, is parallel throughout.

The ends of these cross-rails are housed into the halfits for a distance of $\frac{1}{8}$ in., and the joints of each are secured with round-headed screws as shown in the drawing.

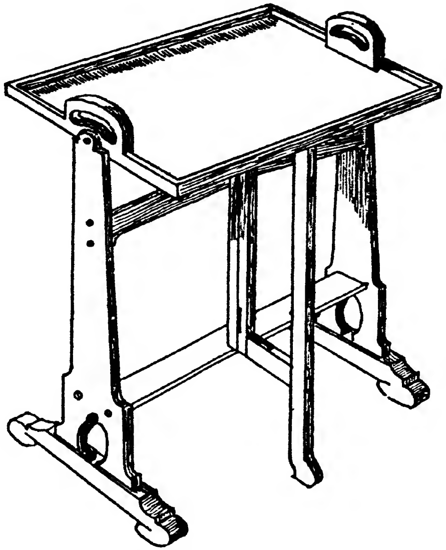


Fig. A.—The Tea Tray and Stand.

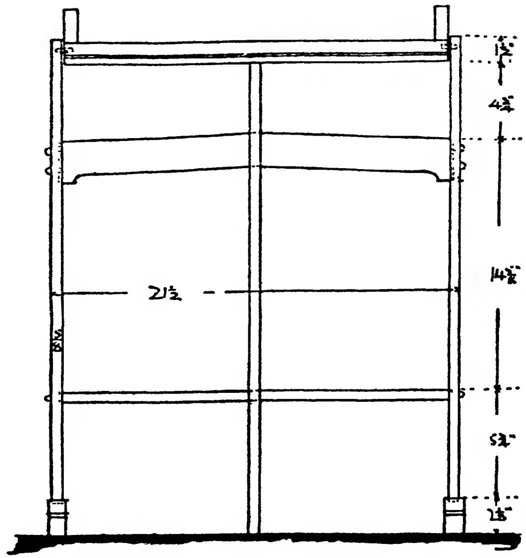


Fig. B.—Dimensions of Tray-stand Unit.

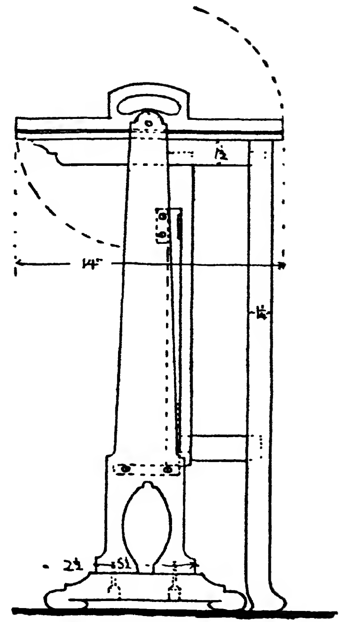


Fig. C.—Side View, showing Dimensions.

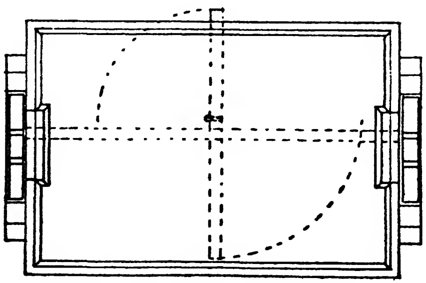


Fig. D.—Plan View, showing Tray.

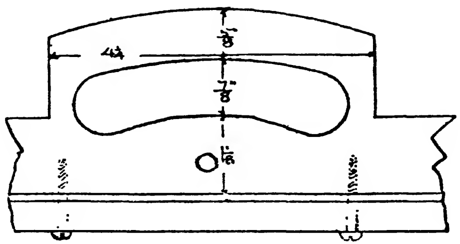


Fig. E.—Details of Handle Part.

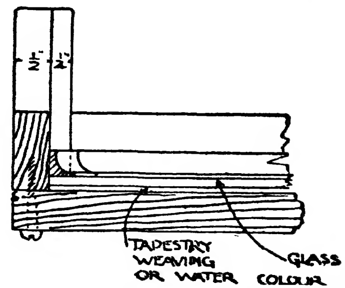


Fig. F.—The Finish of the Tray Surface.

The framed support for the tea tray is hinged on to a hinging piece $\frac{5}{8}$ in. square, which is screwed to the top cross rail of the stand and is housed into the lower shelf. The frame itself is $\frac{5}{8}$ in. thick and is mortised and tenoned together. The horizontal rails are $1\frac{1}{2}$ in. board, while the inner vertical piece is $1\frac{1}{4}$ in. and the outer stiles are cut from 2 in. board. The top rail is shaped on the end and the hinging stile is checked out so as to receive the fixed piece which is connected to the stand.

The Hinges.—The hinging is done with $1\frac{1}{2}$ in. edge brass hinges and the bull of the hinge can be set either way so that the hinged support may fold to the left or the right hand.

The Tray.—The tray is built on to a piece of $\frac{1}{2}$ in. thick plywood with the frame and handles cut from the one piece.

A drawing of the handle is shown at Fig. E, which is cut from the side part of the surround frame.

To the inside of the handle is glued a $\frac{1}{4}$ in. piece with the grain of the timber running up and down; this prevents the handle from being easily broken and gives it sufficient thickness to form a comfortable grip.

The bottom of the tray may be left with the upper surface of the plywood exposed to view, or the working surface of the tray may be formed by covering the plywood with a piece of tapestry and a piece of glass, the glass and tapestry being held in position by a cavetto moulding filling in the internal angle between the surround and the bottom of the tray.

Finish the stand with french polish in the usual way.

TEA WAITER

This is a very useful article for both inside and outside the house. On it, plates, etc., can be carried from the kitchen to the living-room; or from the house into the garden when meals are taken outdoors. It is quite simple to make.

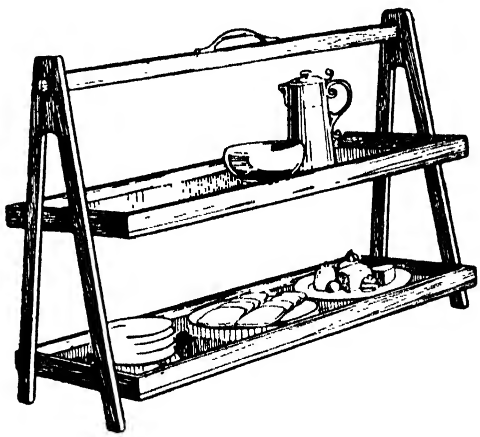


Fig. A.—The Finished Tea Waiter.

The Trays.—The two trays are made first. The size is immaterial; 24 in. by 12 in. is convenient for general purposes. Cut the tray bottoms from $\frac{3}{4}$ in. deal (this finishes about $\frac{5}{8}$ in.), and square them up. The edgings are of 1 in. by $\frac{1}{4}$ in. deal; they are made in the form of two frames equal in size to the bottoms, and are butted and nailed together at the corners. It is desirable to slightly round the top edges. When they have been put together, screw the bottoms to them and glass-paper the outer edges.

Each of the end supports consists of three pieces, two uprights and a

joining piece at the top. The inner edges of the uprights are tapered at the top so that, when fixed to the joining piece, they are splayed outwards. Use $\frac{3}{4}$ in. stuff for all pieces. The joining pieces are made as shown in Fig. C. A rectangular mortise is cut in each near the top to take the top cross-bar to which the handle is fixed. Note that a shoulder is formed on the cross-bar. The ends of the various pieces are shaped as shown in Figs.

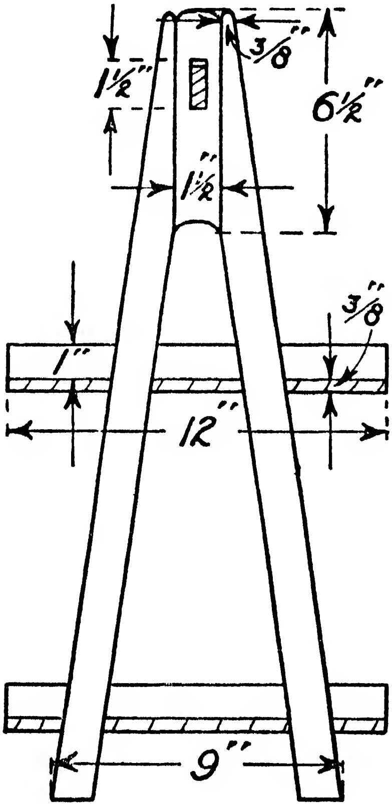


Fig. B.—Dimensions of the Tea Waiter.

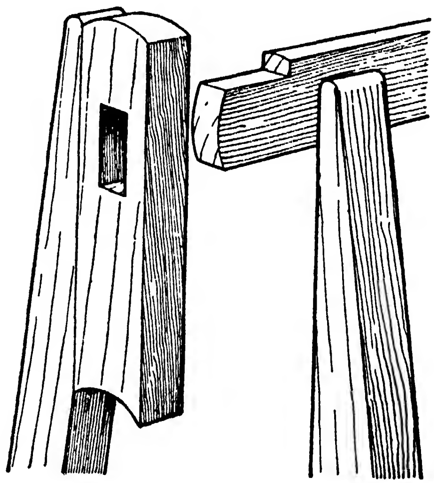


Fig. C.—Detail of the Cross-member Joint.

B and C, and all should be glass-papered ready for assembling. Glue the tenons of the cross-bar into their mortises, place the trays in position and screw them. A brass handle can be screwed to the cross-bar.

The Finish.—The whole can be finished with stain and polish; or it can be varnished. If varnish is used it is necessary to first coat the wood with size to prevent the varnish sinking into the grain and drying unevenly.

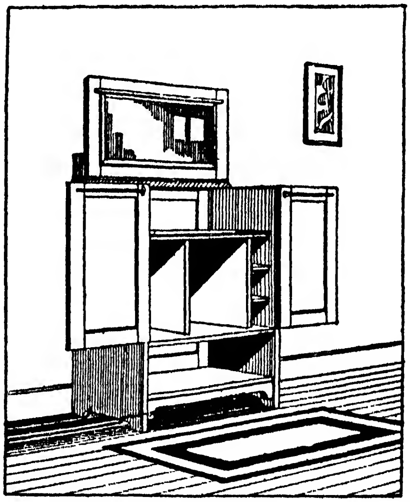
TOILET CABINET

Although most houses nowadays have a bathroom, some sort of toilet table is still useful to have in the bedroom, and an idea for a fitting on these lines is described.

Fig. A illustrates the cabinet open, and Fig. D the same when closed, whilst Fig. B is a side elevation of the fitting with the top closed. Fig. C is a section, Fig. E the plan, and enlarged details are supplied at Figs. F, G, H, and J.

Dimensions.—The principal dimensions are given in Figs. A, C, E and J, but no sizes are given for the divisions of the interior as these would vary according to the size of the toilet articles used.

The Sides.—The sides are $\frac{7}{8}$ in. thick, raggled to take the three $\frac{3}{4}$ in. shelves, and also rabbeted $\frac{5}{8}$ in. by $\frac{3}{4}$ in. on the back edge to take the back panelling, as shown in Fig. F. The back panel, Fig. K, consists of two stiles, $3\frac{1}{2}$ in. by $\frac{3}{4}$ in., one top rail, $2\frac{1}{2}$ in. by $\frac{3}{4}$ in., and a mid and bottom rail each 3 in. by $\frac{3}{4}$ in. (Fig. J), checked for a plywood back. This back panel is screwed into the rabbets left in the sides.



A Bedroom Toilet Cabinet.

The Top.—The top, Fig. J, is $\frac{7}{8}$ in. thick, moulded on edge and screwed to a hinging piece, 3 in. broad by $\frac{7}{8}$ in. thick, shown at Figs. G and J, which is also moulded on edge to correspond with the opening part of the top and screwed to the top of the sides.

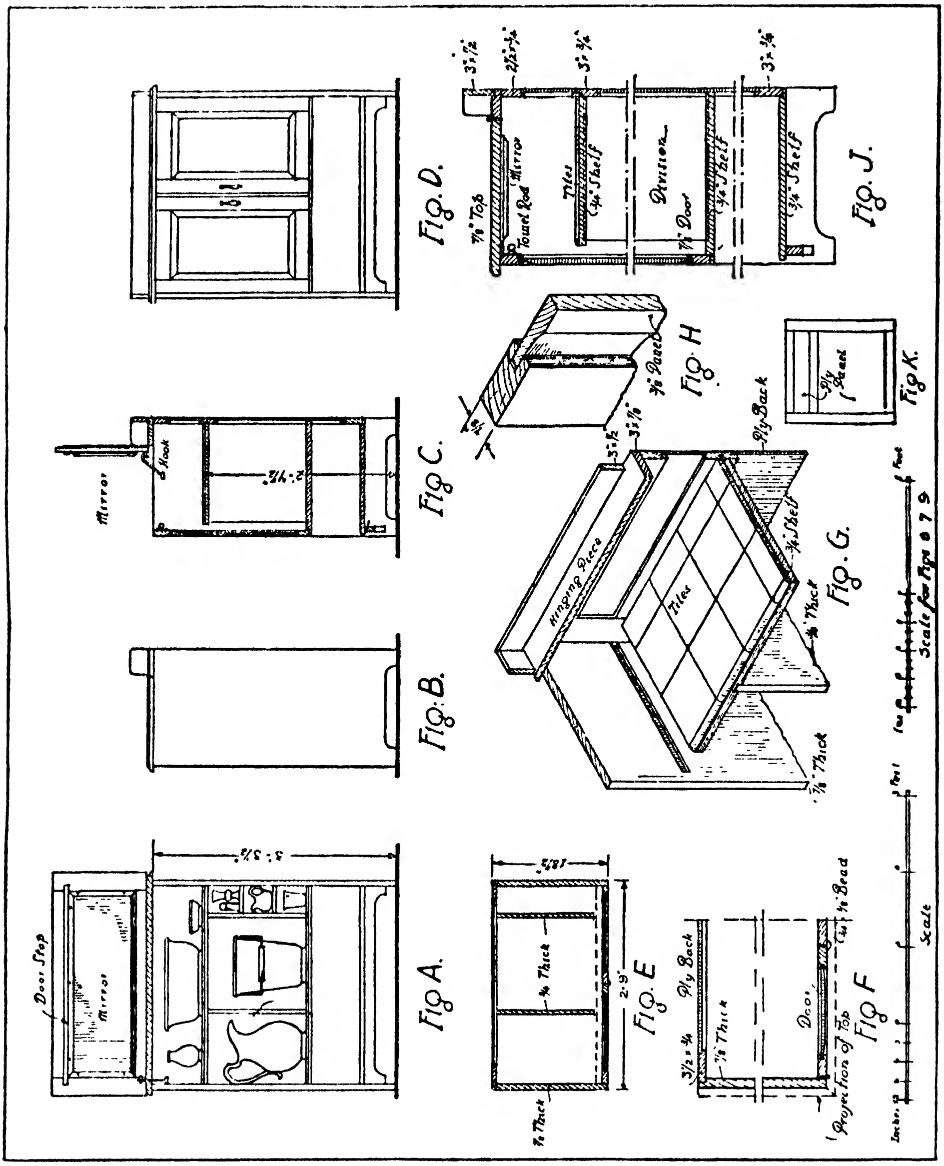
A small upstand, 3 in. by $\frac{1}{2}$ in., Figs. G and J, is tongued into the top of the hinging piece. To the under side of the top is screwed a mirror and also a stop, 1 in. by $\frac{3}{8}$ in., for keeping the door in position when closed (see Figs. A and J).

The Shelf.—The shelf on which the basin rests is $\frac{3}{4}$ in. thick, and about 16 in. wide, and should be covered with a marble slab or tiles, the latter being fixed by painting the top of the shelf with thick paint, and whilst the latter is still wet bedding the tiles with putty. This shelf is tongued into the mid-rail of the back panelling, Fig. G, and raggled into the sides, as are also the remaining two shelves. The shelf at the foot of the door is rabbeted along the edge to form a stop for the latter, whilst the lower shelf is rounded on edge and kept back about $\frac{3}{4}$ in. from the front edge of the sides. Under this bottom shelf is a shaped piece out of 3 in. by $\frac{3}{4}$ in., which is tenoned into the sides.

The divisions are $\frac{3}{4}$ in. thick, and are checked into the shelves.

The Door.—The door is in two leaves, each $\frac{7}{8}$ in. thick, with stiles and rails $2\frac{1}{2}$ in. broad, the panels being $\frac{3}{8}$ in. thick, Fig. H. To one half of the door is sprigged a $\frac{3}{4}$ in. by $\frac{3}{8}$ in. closing bead, Fig. F, and fixed behind each half of the door is a brass or nickel-plated fitting to take a small towel rod.

A cabin hook and rings are screwed to one of the sides, and to the under side of the top to keep the latter in position when open; the position of this hook is shown in Fig. C.



Constructional Details and Dimensions of Toilet Cabinet.

One half of the door is fixed in position when closed by means of two small slip bolts, whilst three pairs of hinges and two bronze cupboard turns comprise the remainder of the ironmongery necessary.

TOOLBOX FOR THE HOME WORKSHOP

The toolbox illustrated will be found particularly useful for the home workshop and garage. Its dimensions will depend on the tools it is required for, but proportions should be about as shown—length nearly twice its width, and depth less than the width. A till about half the width of the box rests on ledges at the ends and can be lifted out. Cleats, as seen in Fig. A, are screwed to bottom and cover of box. Their purpose on the cover is to strengthen and prevent warping or splitting. On the bottom, besides strengthening, they raise the under surface and leave room for getting the fingers under for lifting the box. In length the cleats should not extend quite to the back and front edges of the box. A plain nailed-together box is shown in preference to dovetailed joints.

Construction.—The wood used may be deal, $\frac{3}{4}$ in. thick for sides, bottom, and cover, and 1 in. thick for ends. Cleats may be $\frac{3}{4}$ in. thick

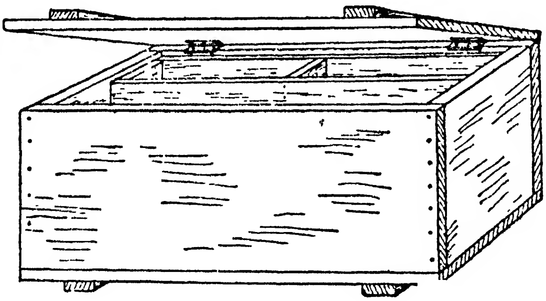


Fig. A.—The Completed Toolbox.

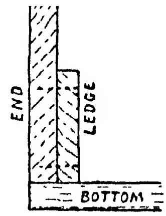


Fig. B (Below).—The Tray and its Fixing.
Fig. C (Above).—The Till Ledge.

and ledges for till $\frac{1}{2}$ in. thick or less. The till may be of $\frac{1}{2}$ in. wood with $\frac{3}{4}$ in. ends. The parts are prepared in pairs, front and back of box alike in length and width, ends alike, and bottom and cover alike, all with edges square and parallel with each other. Sides and ends are then put together with $2\frac{1}{2}$ in. wire nails and then the bottom nailed on. The position of hinges can be seen in Fig. A. An ordinary box lock can be fitted with a keyhole in front or a hasp and staple for a padlock can be used.

The till (Fig. B), simply nailed together, is shown with a middle division, but it may have more than one division or it may have none at all, depending on what you find suits the tools best.

Fig. C shows in section one of the till ledges nailed inside the box. Divisions in the box itself may be desirable for keeping tools in place.

TYPING STAND

Those who do typewriting will find that the stand shown in the accompanying sketches is very useful when copying manuscript, etc. To make this gadget is merely the work of a few minutes. It consists of a flat piece

of wood measuring, say 10 in. by 12 in., which is supported at a convenient angle by means of a thick wooden strut glued to the back of it.

A couple of stout rubber bands are passed over the sides of the board and secured at the back with four drawing-pins, as shown in Fig A.

The manuscript to be copied is slipped under the rubber bands, as shown in Fig. B, and the stand placed in a convenient position near

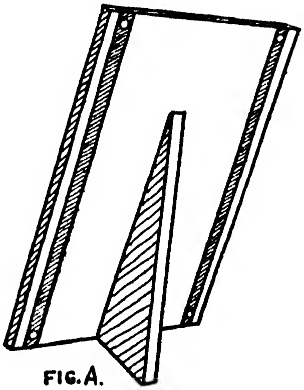


FIG. A.

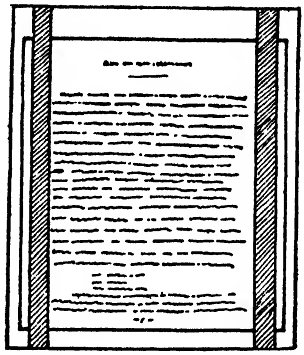


FIG. B

Stand for Holding Manuscript for Typing.

the typewriter, so that the manuscript can be read with the minimum of effort. As each sheet is copied it can be pulled out from the rubber bands, thus exposing the next sheet to be done, and so on.

This simple arrangement saves time, facilitates typing, and enables the typist to sit upright instead of having to bend over the manuscript on the table.

UMBRELLA STAND

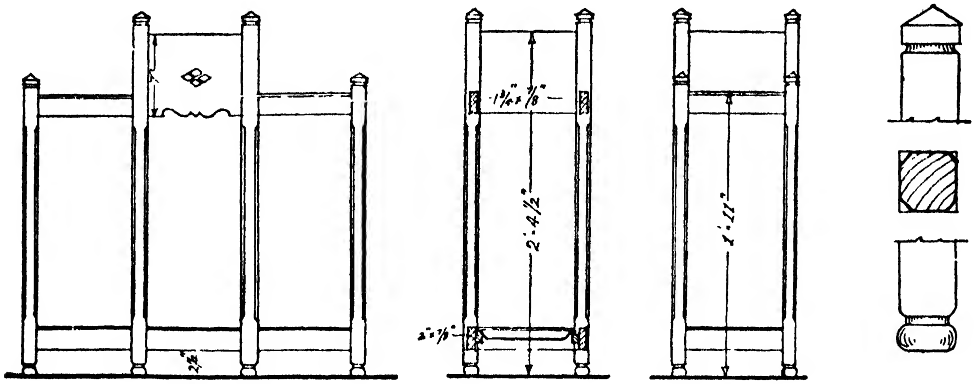
With umbrellas of varying lengths nowadays, a stand specially made to take the chubby umbrella carried by the lady as well as the ordinary umbrella carried by the mere man will be found extremely useful, and by having separate compartments to take the different sizes of umbrellas, damage, sometimes occasioned by the longer umbrellas being stuck against the smaller ones, is prevented.

The construction of the stand is quite within the scope of the amateur craftsman, as the making of it is a plain straightforward job.

Construction.—The legs, shown to a large scale, at Fig. A, are $1\frac{1}{4}$ in. square, stop chamfered on the edges, and having moulded heads and feet. The top and bottom rails—with the exception of the top centre portion, which will be dealt with later—are $1\frac{3}{4}$ in. deep by $\frac{7}{8}$ in. thick, and 2 in. deep by $\frac{7}{8}$ in. thick respectively, rounded on top edge, and mortised and tenoned into the legs as shown at Fig. D.

Between the legs of the centre portion, at the top, is fitted a shaped front piece and plain back and side pieces. These pieces are $\frac{5}{8}$ in. thick

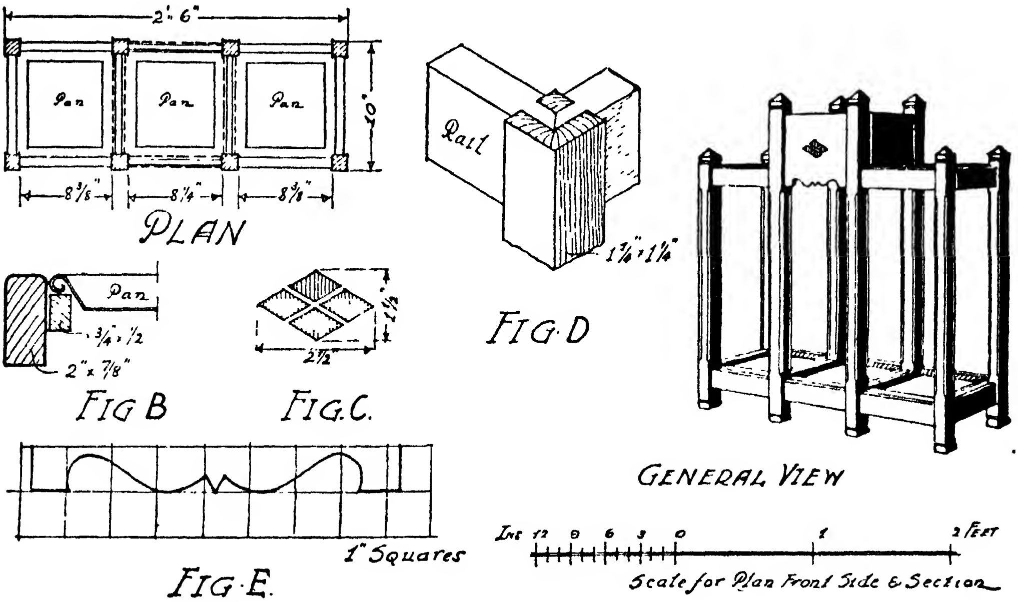
by 7 in. deep, and are housed into the legs. On the front moulded piece—a detail of the moulding of which is given at Fig. E—is pierced a diamond shape according to the details given at Fig. C.



FRONT SECTION SIDE FIG A

Details and Dimensions of Umbrella Stand.

The three pans are supported on fillets screwed to the bottom rails as shown at Fig. B. These fillets are ¾ in. deep by ½ in. thick.



Further Details of Umbrella Stand.

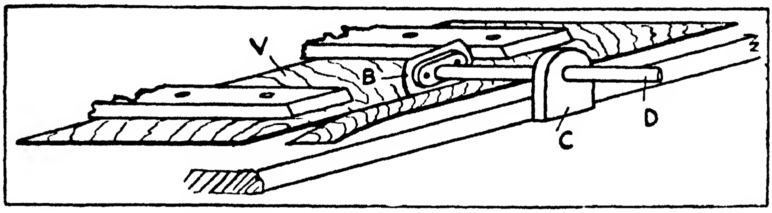
Suitable Woods.—The stand would look well made in oak, but a cheaper wood, such as Oregon pine or cypress, stained and french polished, would provide quite a satisfactory appearance.

VENEER CUTTING

In squaring up and cutting veneer it is necessary first to hold the sheet securely, and secondly to cut the wood with a sharp, thin knife.

A good way to square up and cut veneer and thin plywood sheets is shown in the sketch. The sheet is clamped down to the bench with the wooden bars, after lining up the edge with the edge of the bench.

A carpenter's marking-off tool is modified to take a safety-razor blade, B, as indicated. The slide of the gauge can be fixed at the proper distance



Showing how to cut Veneer Squarely.

from the blade B, so that when it is run along the edge of the bench the blade will cut off a strip of the veneer, leaving a clean straight edge. The safety-razor blade must be held securely, both at the front and back, so as to leave only a small amount of the blade projecting and to give a stiff cutting portion.

WALL BOARDING, HIDING JOINTS IN

When papering or distempering walls which have been built of asbestos boarding or similar material, the joints are liable to give trouble by cracking and spoiling the finished appearance. Even if the job is satisfactorily finished in the first instance, subsequent shrinkage and expansion may cause the joints to open. A way to prepare joints before papering is to make them as neatly as possible. Make up a mixture as follows : 5 lb. of whiting, ½ gal. of liquid glue, ½ pint of oil paint of a light colour, and ½ pint of linseed oil; these should all be mixed well together and the joint painted with this. This paint is thick, but can be applied by a paint brush. It will fill up any crevices in the joint and when dry should be smoothed down by sand-paper.

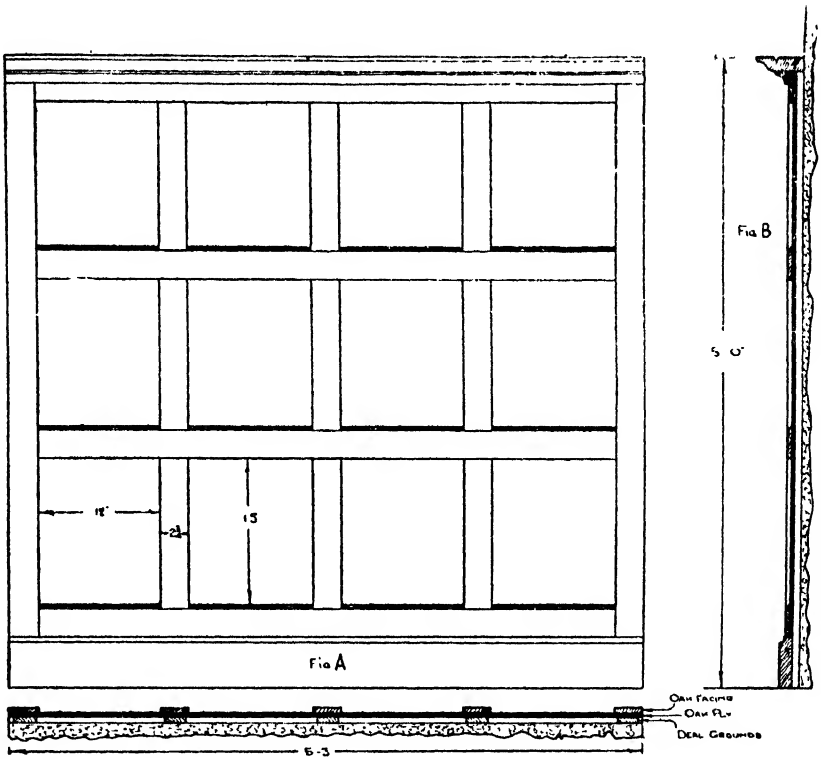
Filling Crevices.—If the joints have been badly made, or there are large crevices, they should first be filled with asbestos string and then painted. This paint is also very efficient for filling cracks in woodwork, etc., as it can be worked well into the crack and finished on the outside with sand-paper and then painted with ordinary paint if desired. It is superior to putty as it does not afterwards loosen, and is easier to work into cracks.

When filling up nail holes in woodwork, etc., make up a putty of enamel under-coater with cornstarch or whiting. This is not liable to stain through as ordinary putty is, which contains linseed oil.

WALL PANELLING

The lining of a room with oak panelling is, of course, an expensive business, so that the method of building up panels on oak-faced three-ply will undoubtedly have its appeal on the grounds of economy.

A scheme that might safely be undertaken by the amateur workman is here illustrated. The right sizes of the panels would be 15 ft. long and



Method of Panelling a Wall.

12 in. wide. For this scheme ply sheets oak-faced one side on birch 36 in. long and 30 in. wide, or 60 in. by 36 in., could be used without waste, and these are a stock size.

Let us suppose that the panelling is to be to a height of 5 ft. to the top of capping; we should then require of the 36 in. by 30 in. size 1½ sheets to cover a space 5 ft. high and 3 ft. wide, since the ply only extends 1½ in. under top and bottom rails and the skirting and capping account for about 6 in. of the height.

Size of Panels.—It will be seen that the size of the panels would be planned according to the wall spaces, so as to get multiples of a convenient width. The ply would then be cut and fixed so that all joints

would be covered by rails or muntins. If the wall has a good plaster face it may be possible to nail the ply with stout $\frac{3}{4}$ in. panel pins direct on to this.

Plugging the Wall.—If the wall is not suitable or presents a brick face, then grounds must be secured by first plugging the wall and nailing. Rough battens $\frac{1}{2}$ in. by 2 in. should be arranged vertically behind every row of muntins and stiles and reach from the floor to the underneath of the capping. It is assumed that skirting is not yet fixed or would be removed and refixed on the face of the panelling. The bottom rail should be $3\frac{1}{2}$ in., allowing for skirting to cover $\frac{1}{2}$ in., but all other rails, stiles, and muntins could be 3 in. or $2\frac{3}{4}$ in. wide finished, and $\frac{1}{2}$ in. or $\frac{3}{8}$ in. thick. It is obvious that these facing pieces must be perfectly uniform as to thickness to present a level surface at joints when assembled. To this end it is desirable and cheapest that it should all be prepared and thicknessed by machine. Any machine joinery would give an estimate for preparing all stiles, rails, and muntins with joints cut dead true, and scribed, and this vastly facilitates a job of this kind.

Fixing the Panelling.—When fixing the panelling determine first by calculation the total height of the capping and by means of straight-edge and spirit level mark a line to which the top of grounds should come, then divide up the spaces, working to centres of muntins. Having fastened the ply to wall or grounds, have your horizontal rails marked over to show the positions of muntins. Then, having fixed one stile perfectly plumb, fix horizontal rails, using a muntin as a guide for distance here and there. The stile being plumb and rails already marked, each muntin placed in its position should be perfectly vertical. It is of the utmost importance that rails and rows of muntins should be level and plumb or the result will be disastrous. Stiles need only appear where the panelling reaches to a corner of the room or round a pier or projecting wall, or adjoining the architrave. But since in genuine framed panelling a long muntin is introduced as a tie to the framing or to break up too long lengths of horizontal rails, this plan might be followed in the case of a long wall space. Rails and stiles are bradded on to the ply. Muntins will have a couple of brads or panel pins at the upper end and through the scribed portion into the chamfer of the rails. These punched in neatly and filled with wax will be imperceptible. The capping grooved for plaques is nailed on to the top rail and supported by a cavetto mould underneath. These will be carefully mitred wherever necessary. Skirting, if planned in oak specially for the scheme, need only be of $\frac{1}{2}$ in. material square-edged or chamfered. If a deal skirting is replaced it can be stained to tone. Oak-faced ply is usually sanded ready to stain and polish, and if the facing pieces are carefully applied little need be done towards flushing the joints that a flat cork and sand-paper will not accomplish. An oil stain to the desired colour should be applied and the finishing done with a Jacobean wax polish. The scheme described is that illustrated in elevation and in vertical and horizontal section.

WALNUT FINISH ON FURNITURE, IMITATION

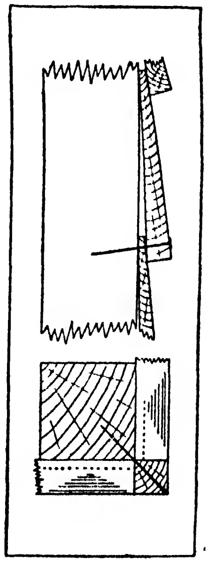
Furniture, when grained to imitate choicer furniture woods, is rarely built up in oil colours as used by the house painter. The new wood is coated several times with a mixture of glue or patent size and finely crushed or gilder's whiting, tinted to form the groundwork of the finish desired; thus venetian red is added for mahogany, and yellow ochre for oak or walnut. The mixture is applied hot and should be well worked in. When a solid body has been grained, apply a coat of clear size.

The Graining.—The graining can now be done on this surface with oil colours as used by painters and decorators—or they may be mixed in beer as a binder. If a plank walnut is desired, take a quantity of umber ground in beer, and with a sash tool cover the entire surface; wipe out the necessary gradations of tone with a sponge and soften or blend all together with a badger softener. To put in a knot, take the sponge between the thumb and finger and give a twist or circular movement and soften off. To imitate burr walnut will require more skill, since a series of irregularly bound knots will be wanted, tied with streaks or veins, and so blended in clusters that there is no appearance of formality. If the furniture in hand has already been painted or polished, the present surface must be cleansed from grease, etc., by washing with warm water in which common washing soda has been dissolved—a teaspoonful to 1 gal. On a painted surface apply paint as used by house painters. Articles built up in size or oil paints should be finished by the application of one or two coats of inside oak varnish.

WEATHERBOARDING, FINISHING CORNERS OF

The use of weatherboarding for garden sheds will be found to present some little difficulty with regard to the corners.

It is assumed that the boards are cut to the exact overall dimensions of the shed and nailed in position. It will be seen from the drawing that triangular spaces are left between the corner post and the side boarding, due to the method of overlapping.



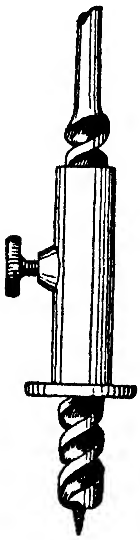
Method of protecting the Edges of Weather-board.

The same thing will occur with the end boards; and in order to cover the spaces, a length of square-section wood is nailed to the corner post by oval brads as shown.

In addition to rendering the shed weatherproof, the strips will also impart a neat and finished appearance to the corners.

WOOD-BORING DEVICE

In boring holes in wood with a twist bit, especially when they are intended to receive dowel pins, it is important to be able to gauge their depth to a given dimension. The device illustrated forms a convenient means for doing this. It may easily be made from a piece of stout brass tubing. The boss for the set-screw is sweated on. The flange prevents damage to the surface of the wood, but if the bit is to be used in a confined space into which the flange would not enter, then it is only necessary to reverse the brass sleeve. This latter should be an easy fit on the bit to avoid unnecessary friction and to prevent it being scraped away by the bit.



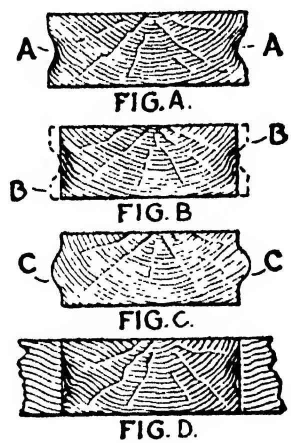
Device for Limiting Depth of Holes in Wood.

WOODEN JOINTS, TO RENDER WATERTIGHT

By preparing the joints as follows, wooden floors, tanks, etc., can be made practically watertight.

Groove the edges by compressing, not removing, the wood (see Fig. A); this can be done at home by hammering or pressing a steel rod into the edge of the board or plank as far as possible without breaking the wood fibre. Then plane the edges to the bottom of the groove (Fig. B). If water is applied now, it is clear that the compressed fibre will expand (Fig. C). Hence, when planks or boards so prepared are nailed edge to edge, the effect of moisture is to make the joints watertight (Fig. D).

Any blacksmith can forge a flat, hook-like tool to be used with a hammer in making the groove.



Watertight Joints in Wood.

WOOD POLISHING, ROUND WORK

Wood articles made on the woodturner's lathe, assuming they are to be left in the natural base colour of the wood, can be given a good polish in the following manner.

For this purpose a transparent french polish is used. It is made by soaking 5 oz. of bleached shellac in a pint of methylated spirit and then adding 2 drs. of oxalic acid to ensure proper bleaching. The dissolved polish should be filtered through linen before use. The work is revolved in the lathe, at a high speed, a somewhat similar pad inside a linen cloth to that employed for ordinary french-polishing purposes is used and it is essential to give the rubber a spot or two of raw linseed oil before polishing with it. Use even pressure on the pad and cover the whole surface as quickly as possible. Continue the motion for some time after

the polish is used up, as it is the frictional effect that gives the final high polish.

In the case of porous woods a filler of the same colour should be used before polishing.

Woods may also be stained before polishing.

Wax polishing gives pleasing results where high finish is not required, and in such cases the rubber is lightly charged with a mixtue consisting of beeswax dissolved in turpentine to a thick creamy consistency. A final finish with a clean soft cloth, followed by a velvet pad of the type used for shoe polishing, will give the best results. For those who have no lathe, the best expedient is to use a transparent cellulose or synthetic resin lacquer, brushed over the work.

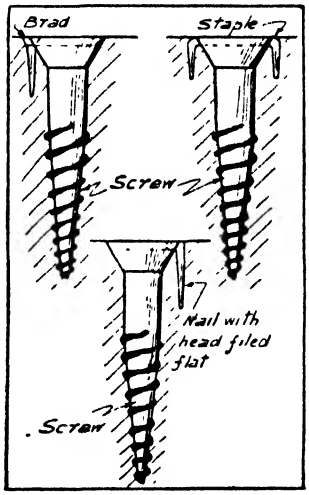
WOOD SCREWS, TO LOCK IN PLACE

Whenever wood screws are used in parts subject to much shock or vibration, for example on the bodywork of cars, they invariably become loose in time. An ordinary single-type lock-washer will often prevent this looseness from occurring where cheese, or round-head, screws are used.

A good tip in the case of countersunk screws is to drive a small wire nail or staple into the wood so as to hold the slot firmly, as shown in the illustrations.

Another method is to insert in the hole some Seccotine or glue, before placing the screw in position. If one side of an oval brad or French nail is filed as shown, it can be used to engage the slot and thus prevent the screw from turning.

Another good method is to file a nick in the side of the head of the wood screw as shown in lower illustration, and after the wood screw is in position to drive a suitably shaped brad or oval nail into the wood so that it fills the nick.

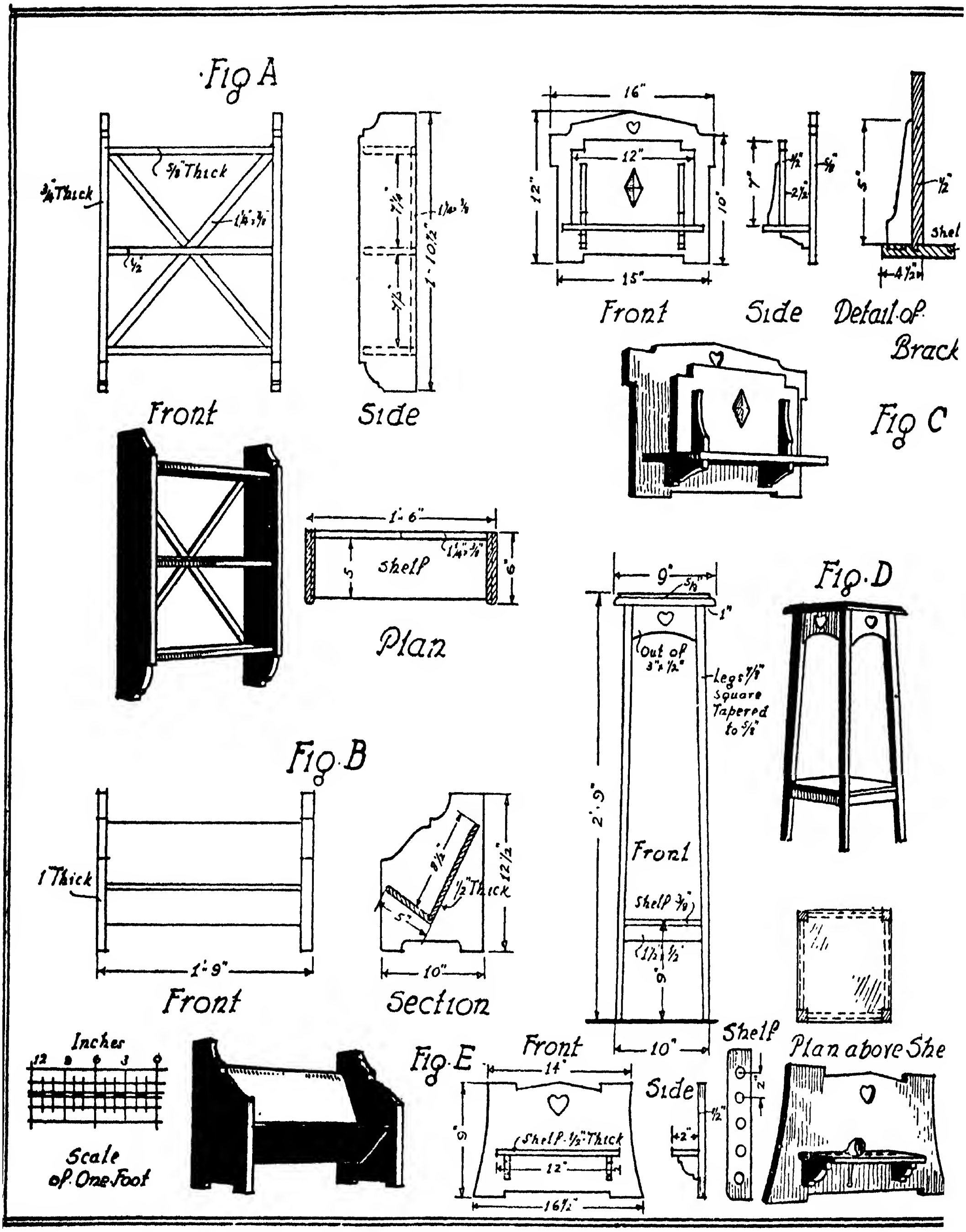


Some Effective Methods of Locking Wood Screws.

WOODWORK ARTICLES OF SIMPLE CONSTRUCTION, FOR THE HOME

The following items have been selected as likely to appeal to the amateur woodworker on account of the simplicity of their construction and the short time required to produce them.

Hanging Bookshelves.—The first item is a set of hanging bookshelves as shown in Fig. A. The moulded ends are $\frac{3}{4}$ in. thick, the three shelves being $\frac{1}{2}$ in. thick, raggled into the ends, skew nailed and glued. Across the back are two cross-pieces, $1\frac{1}{4}$ in. by $\frac{3}{8}$ in., checked into the back edges of the ends and half-checked into each other where they intersect at the centre. These cross-pieces help to stiffen the frame and are, of



Some Useful Woodwork Articles

course, never seen when the books are on the shelves. Two rings for hanging complete the fitting.

Book Trough.—Fig. B illustrates a small book trough with moulded ends 1 in. thick, the trough being composed of two pieces ½ in. thick. raggled into the ends, glued and skew nailed.

Newspaper Rack.—Fig. C is a design for a hanging newspaper and magazine rack. The back is ⅝ in. thick and the small shelf and upright piece at the front are ½ in. thick. The latter is tenoned into the shelf, as are also the two upright supports, which too are ½ in. thick. The two small brackets under the shelf can be tenoned or nailed into the back and shelf, their thickness being similar to that of the upright supports.

Plant Stand.—Fig. D is a plant stand and requires very little description. The legs may be tenoned into the top and glued, whilst the rails under the top, and the lower shelf, are tenoned into the legs.

Pipe Rack.—Fig. E shows a small pipe rack, the material all being ½ in. thick. The small supporting brackets may be fixed as in Fig. C, whilst the holes in the shelf are ¾ in. in diameter and placed at 2 in. or 2¼ in. centres.

All the fittings can be made from mahogany, oak, cypress, or Oregon pine, as desired, stained and french polished.

WOODWORK, FILLING PUNCH HOLES IN

When driving nails into woodwork below the surface, the hollow left by the punch requires filling with putty before painting or polishing. If the putty is pressed in directly on the nail, it is apt to come out when dry, leaving an insightly mark. A little paint applied to the head of the nail will ensure the putty sticking.

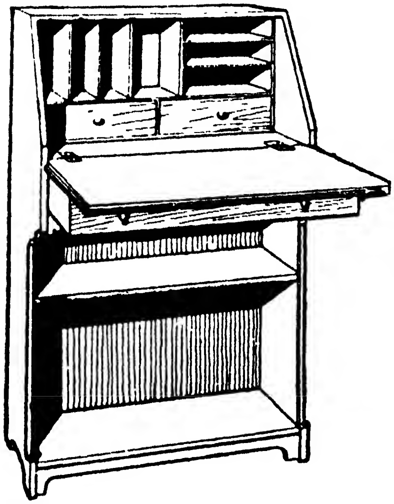
WRITING BUREAU

The bureau shown in the illustration is designed specially for the amateur with only a limited kit of tools, and with but little experience of woodwork. All the joints are quite simple, and the whole can be made from prepared timber obtained at a timber yard. The sides and shelves are made from ¾ in. stuff, the flap from ½ in. wood, and the back from three-ply. A drawer is contained below the flap, and this acts as a support for the flap when open. A stationery nest is fitted behind the flap, and this is made partly from ¼ in. and partly from ⅛ in. stuff. Alternatively, it can be of three-ply wood. For an economical job, pine can be used, or oak if a better piece is desired.

The chief sizes are given in the front elevation and side section in Figs. A and B. The right-hand half of Fig. A is cut away to show a section through the job, whilst a good idea of the construction is given in the perspective view in Fig. C.

Cutting the Sides.—The two sides should be cut out first. They should be cut in the form of two rectangles equalling the overall length

and width. One side can then be marked out. Mark the positions of the top and four shelves according to the sizes given in Fig. B. Remember that as the top is rabbeted and fits over the sides (see inset sketch in Fig. C),



The Finished Writing Bureau.

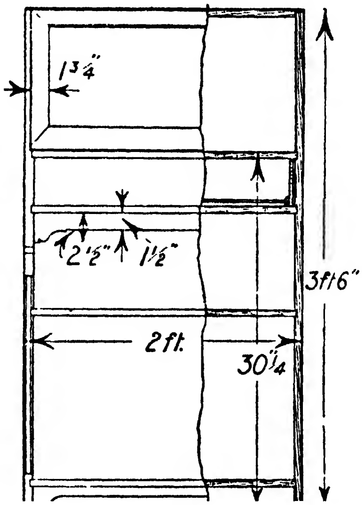


Fig. A.

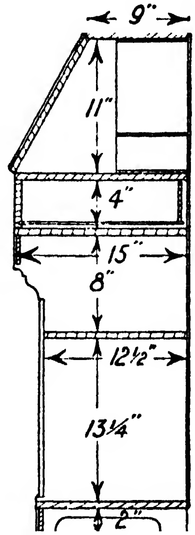


Fig. B.

Dimensions of the Bureau.

the sides must be short of the overall length by the thickness of the lap on the top. All the shelves are grooved in as in Fig. C, so that marks can be squared across the inner surfaces of the sides with a chisel. The sloping part of the top is marked next. Fig. D shows how this is done. As the flap is ½ in. thick, and has a border of ¼ in. stuff, which overlaps and forms a rabbet, allowance must be made accordingly. If the position of flap is drawn out full size on the side, there should be no difficulty. The shaping at the front edge and the bottom, too, can be marked out and cut. The remaining side can be marked from that completed.

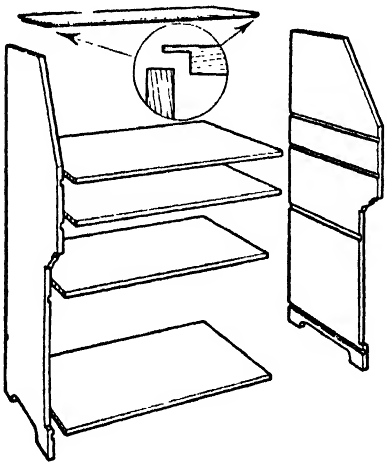


Fig. C.—The Sides and Shelves.

A decorative effect is given to the front edges by the application of half-round mouldings, as shown in Fig. E. Allowance should be made for these when marking and cutting the sides, but the pieces should not be applied until after the job has been put together. The various grooves can be cut by first sawing the sides with a tenon saw and then removing the surplus with a chisel. They can be finished off with a router. It will be found advisable to cut the grooves before shaping the front edges.

Making the Shelves and Flap.—The top and four shelves must be cut out next. The shelves are all the same length and allowance must be made at both ends for the grooves into which they fit. The top equals the overall width of the job and has rabbets cut at both ends to fit over the sides. These points are clearly shown in Fig. C. The front edge of the top is bevelled both top and bottom. The top bevel conforms with the slope of the sides and that at the bottom is at right angles with it. When all the pieces have been cleaned up the whole can be assembled. Glue and

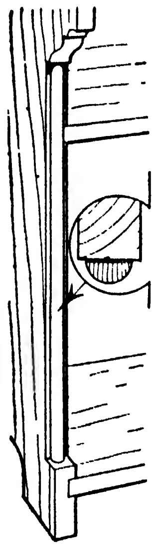


Fig. E.

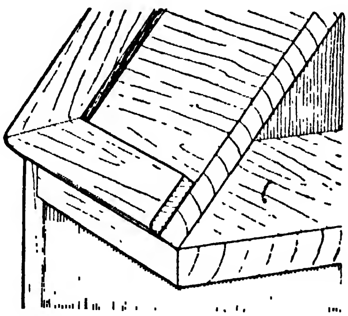


Fig. D.

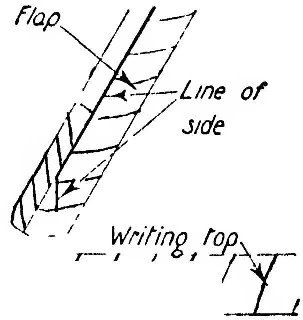


Fig. F.

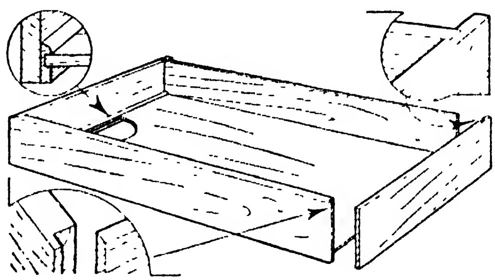


Fig. G.

Some Constructional Details of the Writing Bureau.

nail all the shelves to one side first, fix the other side, and apply the top. All nails should be punched in and the holes filled in with coloured wax. Before placing the job aside for the glue to set, test it to see that all parts are square.

The construction of the flap is shown in Fig. F. A piece of ½ in. stuff should be planed to fit just in the space allowed for it. Quarter-inch battens are then applied to the edges as shown. Those at the sides and at the top overlap to form a rabbet, but that at the bottom is flush. The corners are mitred and the pieces fixed with glue and nails. The top edges can be rounded over after the battens have been fixed. Specially wide

hinges are obtainable with which to hinge the flap. A flush lock can be let into the top.

The Fittings and Finish.—The stationery nest is shown in Fig. H. The sizes for this should be taken from the actual job, into which it should fit hand-tight. For a good-class job the partitions can be fitted with a V-joint. As shown in Fig. H, they are simply butted. The top, bottom, and two sides are mitred at the corners and the front edges are rounded over. Drawers can be fitted into the lower spaces if desired, and a door to the upper centre compartment. The whole is fixed in position with small screws driven through the bottom.

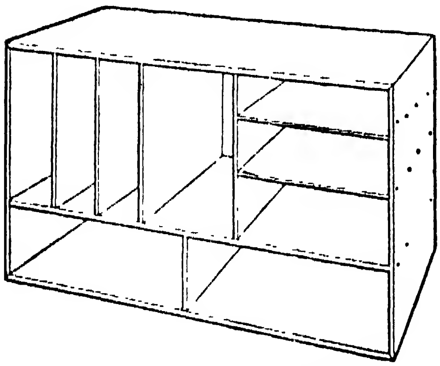


Fig. H.—The Stationery Unit.

Fig. G shows the construction of the drawer. The front corners are rabbeted, as shown in the inset sketch, and grooves are cut near the back to take the back. The bottom is supported at the sides by small grooved slips, as shown, and a corresponding groove is worked in the front. The drawer should be very carefully fitted, as it has to support the flap when open. The whole can be finished by first staining a suitable colour, and finishing with wax or french polish.

SECTION 3

CEMENTS AND ADHESIVES

CASEIN GLUE, MAKING WATERPROOF

Casein glue can be made much more durable and highly resistant to moisture by the addition of copper sulphate.

Three parts by weight of copper sulphate should be dissolved into 30 parts of its bulk of water. When completely dissolved it should be poured in a thin stream into 500 parts of glue. The glue should be stirred vigorously for fifteen minutes so that the copper sulphate is completely dissolved in it; the glue will turn violet coloured when completely mixed. This will render the glue nearly as moisture-resistant as blood-albumin glues. This treatment does not reduce the life of the glue or alter its workability.

CEMENT, ACID-PROOF

The following are two formulas for acid-proof cement:

(1) Asbestos, in fine powder, 2 parts; barium sulphate, 3 parts; sodium silicate, 2 parts; mix; takes several hours to set. If potassium silicate is used, the mixture sets almost immediately. (2) Finely powdered glass, 4 oz.; sodium silicate, a sufficiency. Make into a paste. The glass must be in the form of "flour."

CEMENT, CASEIN, FOR FILLING HOLES AND INTERSTICES IN STONE

Mix 4 parts slaked lime and 4 parts fine sand with 1 part by weight of casein and enough mineral colour to match the stone with sufficient water to form a paste.

CEMENT, MASTIC

A strong cement useful for many purposes on outside work such as repairing stucco, bedding stone, etc., is made by mixing litharge or massicot with about eight times its weight of silver sand or brickdust and adding boiled linseed oil in sufficient quantity to make a thick paste. Another good recipe is as follows: 5 parts clean, dry sand, 5 parts pow-

dered limestone, 1 part of red lead. These are thoroughly mixed, and then boiled linseed oil is added in sufficient quantity to produce a putty-like mass. This cement sets very hard in a short time. It will be found greatly superior to Portland cement for repairing stucco-fronted houses, as it can be painted over, although if this is intended to be done the lime should be omitted and whiting used instead.

CEMENT, RUBBER

A cement for affixing rubber to metal can be made as follows :

Soak pulverised shellac in ten times its weight of strong ammonia. The result will be a transparent mass, which becomes liquid without the use of water in three to four weeks. The fluid makes the rubber soft, but it becomes hard after evaporation of the ammonia, and is impermeable to gases and liquids.

CEMENTS AND ADHESIVES

Acid-proof Cement.—For resisting strong acids this cement is made by mixing 1 part of powdered asbestos, 4 parts of sodium silicate (water-glass) and 1 part of silver sand. It should be used when freshly mixed and can at once be hardened by applying a strong mineral acid, e.g. nitric acid.

Amber Cement.—For joining broken parts of amber, dissolve gum copal in ether to the consistency of treacle. Warm the parts to be joined. Apply the cement to each surface and allow to set under pressure. Thick cellulose varnish (transparent) can also be used satisfactorily.

Asbestos Cement.—This cement is used for heat-proof purposes, such as that of filling cracks in firebricks on stoves. It is made by mixing powdered asbestos with sufficient silicate of soda (water-glass) to make a thick paste.

Bottle-top Sealing Cement.—This cement is used for sealing the tops of corks after their insertion into bottles. It is made by melting 4 oz. of white resin and 4 drams of white beeswax. Afterwards, stir into the mixture powdered stone dust or cement to give a thick syrup and apply hot.

An alternative sealing cement is made by melting 5 parts of resin with 1 part of beeswax, using any required pigment to give the colour desired.

Brass to Wood.—The following method will be found to give excellent results when it is desired to permanently attach brass lettering or ornaments to wood, without the use of screws or nails.

Carpenter's glue, of double the usual consistency, is made in the ordinary way. To every pound of glue is added one fluid ounce of glycerine and 1 oz. of slaked lime, allowing the mixture to boil, stirring thoroughly.

The brass is dipped in a dilute solution of nitric acid (1 part of acid *added to* 10 parts of water) to slightly roughen the surface and afford a better grip for the glue.

The metal is warmed, smeared with glue, and pressed into position on the wood, which is also coated where required. The addition of the glycerine prevents the glue from shrinking when dry.

Broken-slate Cement.—The cement generally used to cement broken slates is white lead that has been stiffened with red lead, the two being well kneaded together.

Casein Cement.—Dissolve 1 part by volume of powdered borax in 20 parts of water and add sufficient casein to form a paste.

China to China.—A tube of artist's flake white oil paint is an excellent cement for china or earthenware. Squeeze out a little of the paint along the edges to be mended, press them together, and bind around if possible. Place the mended object where it will not be disturbed for *six weeks*; it will then withstand boiling water in daily use.

Cloth to Wood.—To fasten cloth to wood, take equal parts of glue and isinglass made into a liquid like ordinary glue, and then thicken with tannin.

Fire Cement.—A very effective cement for firebrick joints is made by mixing 100 parts of wet fireclay, 3 parts of black oxide of manganese, 3 parts of silver sand and 1 part of powdered asbestos, with enough water to make a dough. When heated this cement sets hard.

Flexible Cement or Adhesive.—Cut up 12 parts of crude rubber into fine shreds and mix with 4 parts of kaolin and 1 part of animal (mutton) fat. Heat gently and apply whilst warm.

Another flexible adhesive is made by melting 2 parts of crude rubber and adding 1 part of finely powdered slaked lime.

For General Household Use.—Every household needs a general cement, of the cheap and easy sort. Alum and plaster-of-paris, well mixed with water, and used in a liquid condition, is very serviceable.

Glass Cement.—For joining glass parts dissolve sufficient casein in a concentrated solution of borax and water or in waterglass (sodium silicate).

Thick cellulose lacquer will also make sound joints in glass articles.

Hard Glycerine.—A hard-setting cement for fixing glass, porcelain, etc., to metal objects, such as gauge glasses, is made from 10 parts of litharge and 1 part of glycerine.

Iron to Stone or Marble.—Mix together 30 parts of plaster-of-paris, 10 parts of iron filings, and 1 part of sal-ammoniac with enough vinegar to make a paste. This cement sets quickly and should be used at once.

Knife-handle Cement.—Mix together and heat equal parts of resin and powdered bath brick. Pour sufficient into the handle. Heat the tang of the knife and insert into the handle.

Leather to Leather.—Strong cement for uniting leather to leather can be made by soaking ordinary glue for twelve hours in sufficient water to cover it. Then boil and put in tannic acid. When the solution is sticky and resembles the white of an egg, the process is finished.

Leather to Wood.—As used by bookbinders and deskmakers, this adhesive is made by mixing equal parts of starch paste and a strong solution of glue.

Marble Tiles, etc.—Mix by measure 1 part air-slaked lime and 1 part powdered litharge and 2 parts of white Portland cement with enough silicate of soda to make a thin paste.

Metal Letters on Glass, Wood, etc.—The following is an excellent cement for fastening metal letters on glass, wood, marble, etc. Take 15 parts of copal varnish, 5 parts of linseed-oil varnish, 5 parts of oil of turpentine, 5 parts of glue. Dissolve the glue by placing the mixture in a water-bath. When the solution is complete, add 10 parts of slaked lime.

Another glass-to-metal cement is made as follows :

Three ounces of linseed oil, 1 oz. of mastic; heat until dissolved; add 1 oz. white lead, 3 oz. litharge, both finely powdered; heat and stir till evenly mixed; warm the cement and the metal.

Paper to Metal.—Mix together the following parts, by weight : casein, 35; dextrin, 10; rice starch, 10; celluloid varnish, 20; and beeswax, 15.

Pipe Joints.—A good cement for making tight joints in pumps, pipes, etc., consists of a mixture of 15 parts of slaked lime, 30 parts of graphite, and 40 parts of barium sulphate. The ingredients are powdered, well mixed together, and stirred up with 15 parts of boiled oil. Alternatively, white lead, red lead, and gold size, mixed to a pasty consistency, make a very good jointing material. If the joints are clean, ordinary gold size smeared on is probably as good as anything else.

Pram-tyre Cement.—Ten parts each of shellac and gutta-percha are melted together and then 1 part each of sulphur (powdered) and red lead are added. The cement is used hot.

Quick-setting Cement.—Mix together 50 parts of litharge, 5 parts of glycerine and 2 parts of water. This cement sets hard.

Rust Joint Cement.—For filling holes in iron castings or setting under machine pedestals, etc., this cement is made as follows : iron filings, 50 to 60 parts; sal-ammoniac, 2 parts; and powdered sulphur, 1 part. Mix into a thick paste with water and use without much delay.

Stone to Stone, Glass to Iron, etc.—Make a paste of glycerine and powdered litharge and use immediately, as it hardens rapidly. This is very good aquarium cement.

Stove and Boiler Cement.—Mix together the following : dried powdered clay, 6 lb.; iron filings, 1 lb. Make into a paste with boiled linseed oil.

Vulcanite or Ebonite.—Thick cellulose varnish or lacquer, if applied thinly, makes a good joint. Two coats on each surface are necessary, the first being allowed to dry before applying the second one. When the latter is still "tacky," press the two parts together and allow to set under pressure; this will take from three to four hours.

Equal parts of gutta percha and asphaltum melted together and applied hot to the surfaces, setting under pressure, is an alternative cement. Gutta-percha dissolved in carbon bisulphide to a thick syrup consistency is another good cement.

Wood-filling Cements.—An excellent cement for wooden articles can be made by heating together 1 oz. of common resin and 1 oz. of beeswax.

When these two are melted and mixed together, mix in 1 oz. of Venetian red or other pigment to bring the colour of the cement to approximately the colour of the wood.

This cement must be used hot, as when cold it sets like stone.

Another cement for stopping holes can be made by dissolving 1 part of glue in 16 parts of hot water. When this is completely dissolved and cool, mix in some hard-wood sawdust and a little powdered whiting to form a putty-like substance.

The sawdust should be of the same kind and colour as the wood to be cemented.

When this cement sets dry it will be as hard and firm as wood.

Whiting mixed with glue and a small quantity of linseed oil makes another good filler. Any dry colour mixed with gold-size japan and a few drops of turpentine and soaked paper mixed with glue and a small quantity of alum is good. Roman cement is good for large holes. It can be painted on quickly. The interior of holes or cracks requires wetting first with a soft portion of the cement to prevent shrinkage.

RUBBER SOLVENTS FOR CEMENTS

Benzol and carbon bisulphide are excellent solvents for rubber, but have the disadvantage of being inflammable. Turpentine and camphor oil are good solvents, which, though still inflammable, are less dangerous, whilst carbon tetrachloride is both a good solvent and non-inflammable. Whatever solvent is used, it must be added only a little at a time and at intervals, or the solution will take longer to prepare and will not be so good.

SECTION 4

CONCRETE AND ITS APPLICATIONS

BIRD BATH, IN CONCRETE

Partly for humane and partly for decorative purposes, householders are installing bird baths in their gardens. The design illustrated may be easily constructed in concrete. As will be seen from Fig. A, which is a

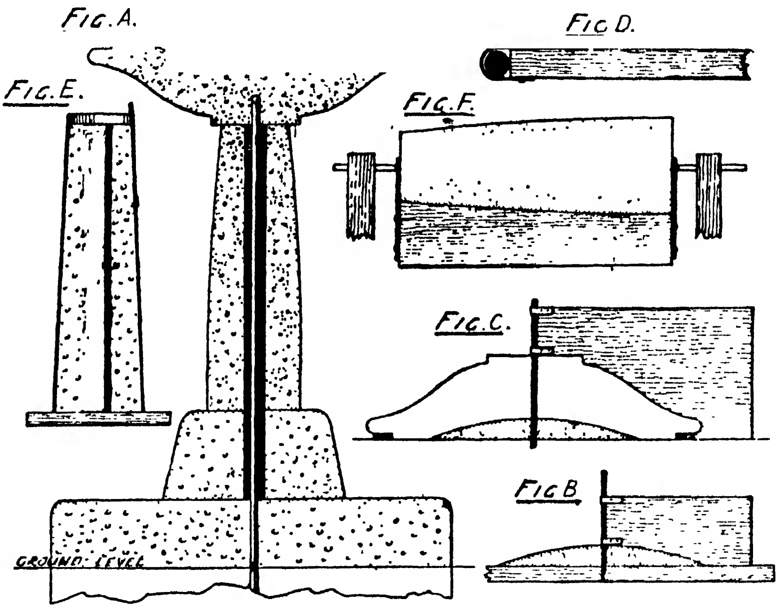


Fig. A.—Bird Bath in Sectional Elevation. Fig. B.—Mould for Interior of Basin. Fig. C.—Mould for Exterior of Basin. Fig. D—Clip for Moulds. Fig. E.—Mode of Casting Column. Fig. F.—Mode of Finishing Column.

sectional elevation, the bath consists of four separate components. The base may be rectangular, consisting of 10 in. of concrete, 6 in. of which is sunk in the ground, in which centrally is embedded a $\frac{3}{8}$ in. iron rod as shown, which must be set truly vertical. That part of the concrete block which stands above ground level may be rendered to a good surface with

cement mortar. It then remains to make separately the other three components.

Constructing the Basin.—Starting with the basin, the procedure would be as follows :

Having made a full-size drawing of it in section, two boards are shaped to the outlines of interior and exterior surfaces, as shown in Figs. B and C respectively. In the centre of a flat and level board, a $\frac{1}{2}$ in. iron rod is fixed vertically to form the pivot on which the boards are to be rotated. Each board is provided with two U-shaped strips nailed on, to slip over the rod, and to ensure that the wooden mould turns truly about the pivot (see Fig. D). The core for the concavity of the basin then is built up on the board roughly with wet sand, and brought to its correct contour by revolving the mould (Fig. B). Cement mortar then is heaped over it till there is sufficient to admit of striking the convex contour, as shown in Fig. C, by the use of the mould there shown.

The Pillar.—Next the pillar may be taken in hand. For this and for the component below it, two pieces of iron gas piping will be required, each cut to the exact height of these two parts. The bore of the piping should be an easy fit over the $\frac{3}{8}$ in. rod. The column may be cast roughly by pouring the concrete into a hollow cylinder made by rolling together a piece of roofing felt or linoleum, and tying it with string. This should be stood upon a level surface with the pipe fixed centrally in it, when the concrete may be poured around the pipe to fill the mould. If a wooden peg be driven into the supporting board the lower end of the piece of pipe may be slipped over it, when the upper end can be held with the finger whilst the filling is being done. The arrangement described is shown in Fig. E. When the concrete has set the column should be threaded upon an iron rod lying on two supports, as indicated in Fig. F, when cement mortar may be plastered over its surface and moulded to shape with a board, as shown in Fig. F. The moulding of the third component would be done similarly.

It should be noted that the column is neither a cylinder nor a cone, but slightly curved in contour, which better pleases the eye than either of the other forms.

Erecting the Bath.—The erection of the bath is a simple matter. Each piece is passed over the rod, and bedded on a thin layer of cement spread upon the surface below it.

The central rod should be long enough to project above the top of the column, when the latter is in place, so as to form a dowel for the basin, but it should not pass more than half-way through the basin, or it may, by rusting, discolour the cement.

The scale of inches appended to the illustrations will enable all dimensions to be determined. A height of 30 in., as shown, would be quite suitable, but a less height might serve.

A fine gravel aggregate should be used for the concrete, the proportion

ORNAMENTAL BIRD BATH MADE IN CONCRETE.

of cement being one to four of the aggregate. The mortar may consist of cement and sand in equal bulks.

It should be noted that the basin purposely is made shallow to preclude the possibility of the birds drowning. Also a flat rim is provided, on which food may be placed.

CONCRETE, HOW TO MAKE AND USE[1]

Concrete work and concrete articles have numerous applications in the home and garden, so that every amateur should make himself familiar with the ordinary methods of making concrete, moulding and utilising this material.

Concrete can be used as a substitute for metal construction, wood and stone parts. It has the advantages that parts constructed of concrete are made in one operation, namely, the filling of the mould or form, and intricate shapes and awkward sizes can be made without trouble.

The home worker and handyman should make a point of having the materials for making concrete available, as once he has become acquainted with the process of mixing the ingredients and the fairly simple process of moulding them, he will find no end of useful applications that will save both time and labour.

Moreover, articles made of concrete have the advantage over wood or metal ones used outdoors of being weatherproof and permanent.

Ingredients of Concrete.—Concrete consists of three principal ingredients, namely, (1) Portland cement, (2) particles of sand or gravel, and (3) aggregate or broken stone, brick, cinders, rubble pieces of coarser grade.

These ingredients are well mixed together with water, and placed in the mould, or form, it is desired to take, in a similar manner to the process of making a metal casting. After a day or two the material sets hard and permanently. The strength or quality of the concrete made depends upon the proportions of the ingredients, and it is usual to adopt different proportions according to the type of article to be made.

In cases where great strength is required a greater proportion of cement is employed, and a smaller aggregate is used.

Thus one of the strongest and best concretes, namely, that used for cisterns, tanks, and similar water-holding constructions, is made of 1 part Portland cement, $1\frac{1}{2}$ parts sand, and 3 parts aggregate; this is known as a $1 : 1\frac{1}{2} : 3$ mixture; it represents about the highest cement proportion used. For most ordinary purposes where a good strong concrete is required it is usual to employ the proportions $1 : 2 : 4$. For the foundations of houses and buildings, floors, paths, steps, etc., concrete of proportion $1 : 2\frac{1}{2} : 5$ is used. Finally, for heavy constructions such as walls, piers, and other structures where the chief requirement is that of weight a coarser concrete of $1 : 3 : 6$ can be used.

[1] We are indebted to the Associated Portland Cement Manufacturers, Ltd., for much of the information and some illustrations used in this section.

Reinforced Concrete.—Although the ordinary domestic user of concrete will seldom require anything stronger than the 1 : 1½ : 3 mixture mentioned, it is as well to know that where articles such as beams, posts, floors supported at their extremities, and similar parts taking stresses are to be of concrete, it is usual to reinforce the concrete on the tension side by means of steel or iron rods, wire netting, or plates.

The reason for this is that concrete is not very strong in tension, although it is extremely so under compression. Thus the tensile strength (or force required to break a rod of one square inch cross-section) of 1 : 2 : 4 concrete[1] is about 450 lb. per sq. in., whilst its compressive strength is about 1,800 lb. per sq. in.

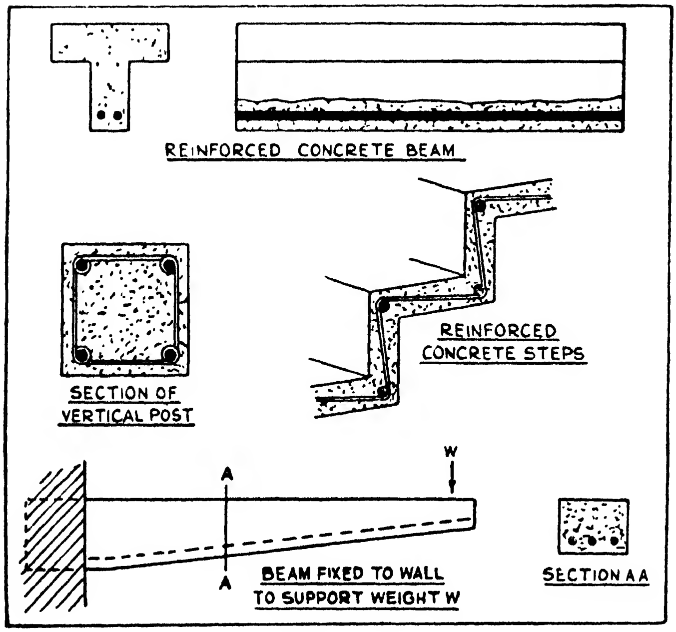


Fig. A.—Some Typical Examples of Reinforced Concrete.

Now ordinary mild steel has a tensile strength of about 56,000 lb. per sq. in. and is therefore about 125 times as strong as concrete in tension. It will therefore be seen that a small rod of steel will have the same strength in tension as 125 times its cross-sectional area of concrete, so that by the simple expedient of embedding small rods of iron or steel in concrete before it sets, one can give it very great strength.

Most modern buildings, floors, bridges, city roads, and similar constructions are now made of reinforced concrete. Fig. A shows a few typical applications of reinforced concrete, the steel rods being represented by the black circles; they will always be found on the tension side.

When it is required to make a very strong concrete structure, for domestic purposes, the concrete may be reinforced with ordinary ¼ or ⅜ in. rod, steel strip, hoop iron (flattened), or even with strong-mesh fencing wire.

Selection of Concrete Materials.—It is important to use the best materials available, and to make use of any local materials for the aggregate.

[1] Twenty-eight days old.

Cement.—This should be a good grade-cement such as that supplied by the British Portland Cement Association. It is delivered in waterproof paper bags, ordinary bags, or barrels, with the maker's name thereon. A sack of cement weighs about 200 lb., but smaller sizes are procurable; a barrel weighs about 400 lb.

The cement readily takes up moisture and will soon become lumpy in a moist atmosphere or even "set" if much water is present. It should therefore be stored in a dry place.

Sand.—The sand used must be clean, coarse, and graded. If it is coated with impurities such as clay or earth it will not bind properly with the cement. The cleanliness of sand can be tested by rubbing it through the fingers or on a sheet of white paper, when any dirt will be apparent. Dirty sand should be cleaned by washing in clean water, using a tray or trough. The sand should be thoroughly stirred whilst the water is flowing over it; the dirt will then float off.

It is not desirable to use sand of too fine texture, as the extremely small particles will require much more cement to coat them, and also a more thorough and longer period of mixing.

It is usual to specify a graded sand, consisting of particles varying from the coarsest to the finest. The reason for this is that the smallest particles are required to fill the "voids" or spaces between the larger particles of the sand and also the aggregate.

Use of Sea Sand.—Where concrete constructions and articles are used near the sea coast, it is usual to obtain the sand from the shore in the vicinity. The salt contained in this sand tends to delay the setting and hardening. It does not appear to affect the strength, however, unless it contains organic matter. Salt tends to make the surface of the concrete efflorescent. Where possible the sand should be washed.

The Aggregate.—The larger solid particles known as the aggregate are bound together with the cement, whilst the sand fills in the voids or spaces, so as to make a solid mixture. The strength and hardness of the concrete depend upon this aggregate to a large extent; indeed it has been said that "concrete is no stronger than its aggregate."

The following materials include those commonly used for strong and hard concrete : granite, gravel, crushed stone, pebbles, shingle, and slag.

Where maximum strength is not of first importance, as in the case of walls of houses, ground floors, paths, etc., it is usual to employ as aggregate one of the following materials : coke breeze, clinker, burnt ballast; or broken brick.

Coke Breeze.—This consists of small pieces of coke, pan breeze, or ashes. These should not contain any unburnt matter or sulphur, ammonia, etc.; otherwise a very inferior concrete will result. Coke-breeze concrete is much used for the inside walls and partitions of cheaper classes of houses, for domestic out-buildings and garages.

It is somewhat porous and there is the possibility of moisture entering constructions made with coke breeze. If possible the use of boiler and

domestic fire ashes should be avoided on account of the unburnt fuel contained; this does not, however, apply to furnace clinker.

Concretes made with coke breeze are lighter and less strong than those made with the aggregates we have previously mentioned.

The methods of making coke-breeze slabs and blocks will be found described under the heading Concrete Blocks.

Clinker.—Clinker is a fused or vitrified furnace product, appreciably stronger and heavier than coke breeze, and free from unburnt or sulphurous matter. It gives a stronger concrete than coke breeze or ashes, but is inclined to be porous. The clinker obtainable from gasworks, refuse destructors, and large steam boiler installations is the best for concrete work.

Broken Brick.—This is much used for concrete, and is better from the point of view of strength and porosity than the two previous materials. It should, however, be carefully chosen, as some bricks contain sulphur and lime.

One advantage of broken brick is that it gives a practically fireproof (in the sense of not splitting under heat) concrete. When using broken bricks care must be taken to remove any adhering plaster, as this contains injurious lime, and to avoid any brickdust in the concrete mixture.

Gravel for Concrete Work.—Gravel is one of the best and most widely used aggregates for concrete, as it occurs fairly widely in this country. It is usually well graded, clean, and consists of hard, strong particles, so that it gives a hard, strong concrete. River gravel is preferable to ordinary gravel having an appreciable amount of clay, for the former is clean and gives better adhesion to the cement and sand.

Too much clay amongst the shingle particles will prevent the cement binding efficiently and so give a weaker concrete. It is usual to pass this through a ¼ in. mesh sieve and to discard everything that goes through the sieve. Gravel containing loamy sand is well suited to concrete aggregates.

Sizes of Aggregates.—The strength of a concrete depends to a large extent on the size of the solid particles. Thus a mixture containing relatively large pieces of aggregate will be less strong than one having smaller ones. It is therefore usual to specify the size of the aggregate for different kinds of work.

For strong structures the largest permissible size is ¾ in.—that is to say, this is the size of the largest particles that will pass through a ¾ in. mesh sieve.

For large base floors, foundations, and large structures, where weight is a primary consideration, aggregates up to 2 in. or 2½ in. are allowed. In such cases the size of the aggregate is relatively small compared with the dimensions of the structures themselves.

Mixing Concrete.—The correct proportions of the materials having been chosen to suit the type of structure, it is next necessary to mix these thoroughly, in order to obtain a compact mass, with all the spaces filled

with the binding cement; every particle of sand or stone should be coated with wet cement.

The best plan is to make a proper concrete mixing-board of suitable size for the work in hand; otherwise a level floor can be used as the next best surface.

A suitable mixing-board for household purposes is one measuring about 6 ft. by 6 ft. made from 6 in. by 1 in. deal boards, and supported at intervals with battens or cross-pieces of 3 in. by 2 in. section with the longer side perpendicular to the boards. These should be nailed together.

If a good deal of mixing is to be done, it will be found that the surface of the wood will wear down in time. To obviate this it should be covered with sheet iron or zinc.

Since it is important to correctly proportion the ingredients, it is best to have available some handy form of measuring-box or bucket.

The quantity or volume of concrete required for the particular ob must be worked out in cubic feet.

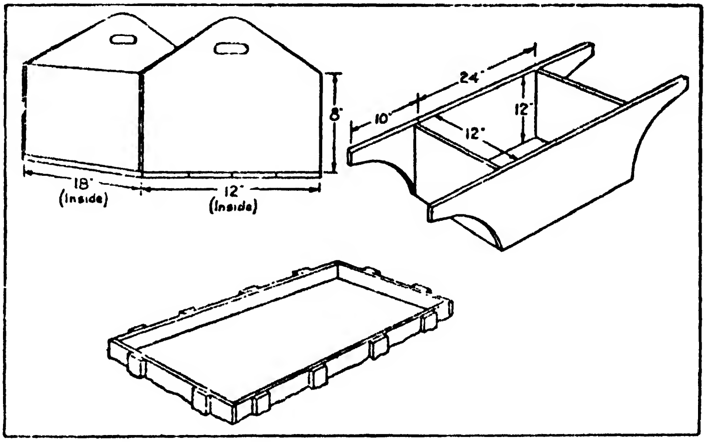


Fig B —(A) and (B). Measuring Boxes for Concrete.
(C) Method of making Concrete Floor.

It is a fairly simple matter to make a strong box of, say, one or two cubic feet capacity and to use this for measuring the ingredients. For domestic and other single-handed work a box of one cubic foot capacity is about as big as one can handle when filled with material.

A convenient shape of measuring-box for home use is shown in Fig. B, Diagram A. Where help for carrying is available, a box of the size and shape shown in Fig. B, Diagram B, will be found more suitable; this has an internal capacity of two cubic feet.

Next, to obtain the quantities of the ingredients for making a given volume of concrete, suppose that it is required to use a 1 : 2 : 4 mixture for making a floor measuring 15 ft. by 10 ft. by 4 in. thick.

First work out the volume of concrete: $15 \times 10 \times \frac{4}{12} = 50$ cubic ft. Now in 7 parts of the mixture there will be 1 part cement, i.e. $\frac{1}{7}$ of the whole, 2 parts of sand, or $\frac{2}{7}$ of the whole, and 4 parts of aggregate, or $\frac{4}{7}$ of whole. So that the:

total vol. of cement required will be $\frac{1}{7} \times 50 = 7\frac{1}{7}$ cubic ft.
,, ,, sand ,, $\frac{2}{7} \times 50 = 14\frac{2}{7}$
,, ,, aggregate ,, $\frac{4}{7} \times 50 = 28\frac{4}{7}$

These quantities should be measured out and mixed in the following manner:

First measure out the sand, and empty it on to the mixing-board. The latter should be big enough to deal with the total quantity of mixture required, unless the concrete structure can be made in two or more stages.

Spread the sand on the mixing-board so as to form a layer of about 4 in. deep. Next lay the measured quantity of cement as evenly as possible over the sand.

Then mix these two ingredients, dry, as thoroughly as possible, using square-ended shovels, and constantly turning the material over and over, until it becomes uniform in colour. Next measure out the aggregate and lay fairly evenly on the top of the cement and sand mixture, and then mix thoroughly with the latter.

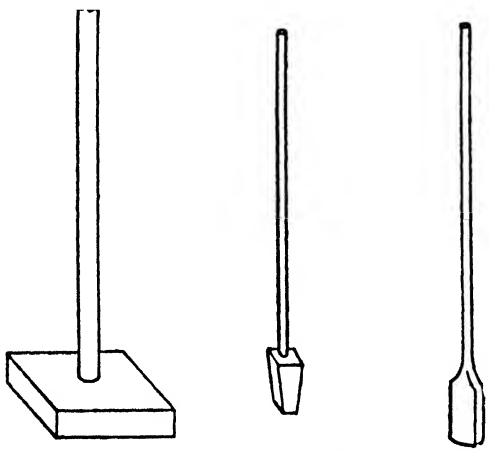


Fig. C.—Ramming and Tamping Tools for Concrete.

Finally add the water. This should be pure drinking water, i.e. water free from acid, alkali, and other impurities. It should not be thrown haphazard from a bucket or hose, but sprinkled uniformly with a water can or garden-type hose sprinkler.

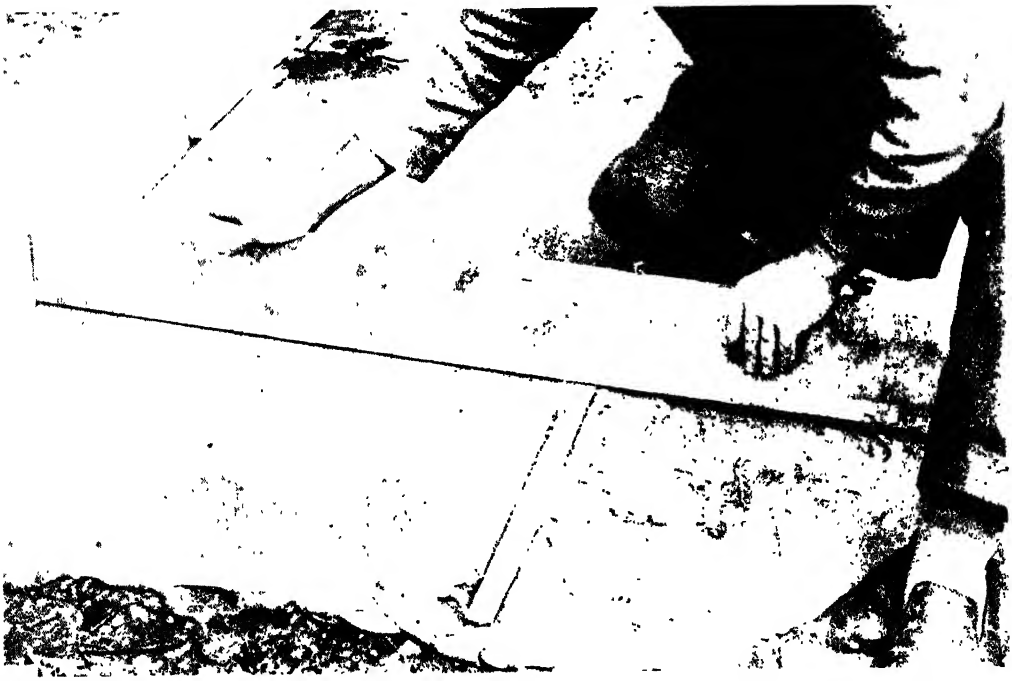
The water should be added gradually, whilst turning over and mixing the materials, until just sufficient water has been added to completely wet the materials. This can be tested by taking a shovelful of the mixture and tamping or beating it down in a small wooden box, when a little water will be seen to just flush the surface; the water content is then about correct. Fig. C shows some typical ramming and tamping tools.

Experience will show when the correct amount of water has been added, and a note should be kept of the quantity used for a given volume of the mixture.

Using the Concrete Mixture.—There should be no delay in using the wetted mixture as soon as it has been thoroughly mixed. The usual procedure is to employ boards to form a kind of mould the interior size and shape of which correspond to the desired form of the finished concrete article or structure.

Suppose, for example, it is a garage floor measuring 15 ft. by 10 ft. and that 4 in. thickness of concrete is required. Having levelled the site and rolled it down, using for preference any solid particles, such as stones, broken bricks, etc., in with the earth, four 6 in. boards are arranged along the four boundaries of the site, so as to just enclose the area required, and to have their upper edges a little over 4 in. from the level of the

(1) Making Mortar Mix the Sand and Cement on a Wooden Board and moisten the Mixture with Water Work with a Shovel until thoroughly mixed



(2) Laying a Concrete Floor Lay Screeds or Guide Pieces of Wood on the Floor with their Upper Edges level Spread the Mortar over the Floor area and level off with a Piece of Board as shown above.

CONCRETE WORK

rolled earth. The boards should be held in place by means of 2 in. by 2 in. posts driven at intervals into the earth as shown in Fig B., Diagram C.

The concrete mixture is now wheeled to the site in suitable loads, in a barrow, and emptied over the site, spreading it with a spade, or spading tool. It is advisable to well water the site before depositing the mixture.

The mixture should be well worked in or tamped all along the boards so as to fill all the spaces. It can then be levelled over by the simple expedient of sliding a piece of board along two opposite edges of the form so as to scrape off the surplus material and thus to leave a flat, level surface. Whatever the shape of the form, or mould, the mixture should be well tamped as soon as it has been emptied in.

Freshly laid concrete must not be allowed to dry too quickly, as when the sun is shining or a drying wind blowing, so that it is often necessary to actually water the surface for a time until the concrete has set. Sometimes damp sand or cloths are spread over the surface for this purpose.

Concrete floors and walls may be surfaced with a cement and sand mixture so as to give a much cleaner and smoother surface.

Time required for Setting.—Finally it is important to allow the concrete to set hard for some days before removing the boards of the form. The actual time required depends upon the size and form of the structure and the state of the atmosphere, i.e. whether cold, wet, warm, or dry.

In a warm, dry atmosphere the concrete will set sufficiently for the form to be removed in a day or two, whereas in wet atmospheres it may require from 2 to 4 weeks.

Concrete. Some Useful Facts.—The following information will be found useful in concrete work and estimates:

1 cu. ft. of Portland cement weighs from 75 to 85 lb. when tightly packed.

1 cu. ft. of river sand weighs about 110 lb.

1 cu. ft. of 1 : 2 : 4 concrete weighs, on the average, about 150 lb.

1 cu. ft. of coke-breeze concrete (1 : 2 : 4) weighs 100 lb.

An average wooden wheelbarrow contains about 2·5 cu. ft. capacity.

1 cu. ft. of Portland cement will make:

4·1 cu. ft. of 1 : 2 : 4 concrete.
5·8 cu. ft. of 1 : 3 : 6 ,,

1 cu. ft. of Portland cement paste will cover 9·5 sq. ft. 1 inch thick.

100 lb. of cement and 1 cu. ft. of sand will plaster $2\frac{1}{4}$ sq. yd. 1 in. thick.

Concrete Blocks.—These can be made by the amateur, and will be found very useful for domestic buildings.

The hollow type of concrete block is the best for dwelling houses, as the air spaces give good heat-insulation properties, whilst the hollow construction enables a much more rigid wall to be built.

Fig. D illustrates some of the more common forms of concrete block in present use, all of those shown being of the hollow type.

The proportions of the concrete mixture used generally consist of

Portland cement 1 part, sand 2 parts, and aggregate 4 parts. The aggregate employed for the best-quality blocks consists of ballast, broken stone, washed gravel, crushed granite, or rock. These materials give a strong, impermeable concrete. For less-important blocks the aggregates used include broken brick, coke breeze, and crushed clinker. The concrete blocks are lighter, less strong, and more porous than the preceding ones. The coarse aggregate should be graded from $\frac{1}{2}$ in. to $\frac{1}{4}$ in. The concrete is mixed by hand, using a mixing-board similar to the one previously illustrated.

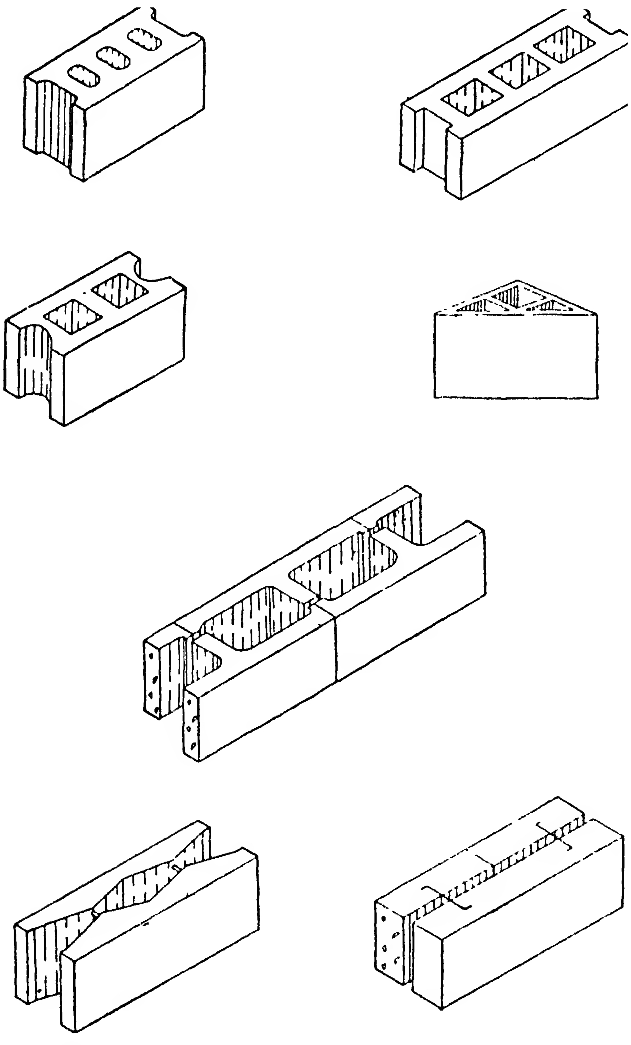


Fig. D.—Common Types of Concrete Building Blocks.

Two alternative methods are employed to ensure the proper consistency to which the material is brought before moulding.

In one method the mixture is made fairly wet, and in the other sufficient water only is added to enable the materials to bind together under pressure.

The moulds for making concrete blocks usually consist of bottomless "boxes" standing on baseboards being firmly attached to these but easily detached. When making numbers of blocks special moulds are used; these are made of such dimensions that by the addition of packing boards and partitions known as liners the same mould can be used for making blocks of different sizes and shapes. The moulds are usually made of wooden boards where a limited number only of blocks is required.

A good method of making the moulds is illustrated in Figs. E, F, G, and H. In this case one end is hinged and the sides are hinged outwards, hooks

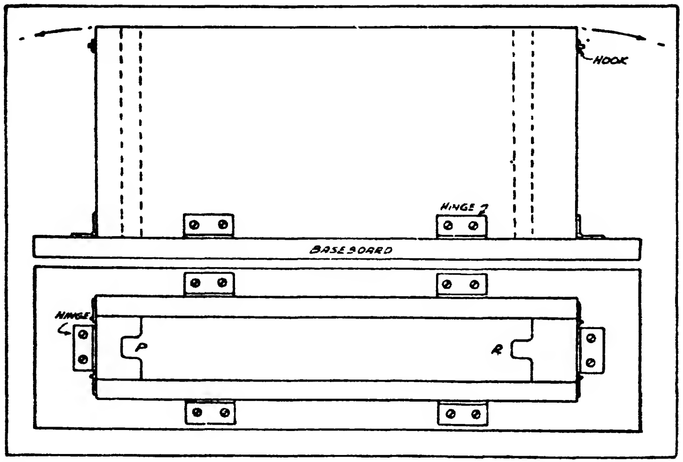


Fig. E.—Wooden-box-type Moulds, with Hinged Sides, for making Concrete Blocks with Keyed Ends.

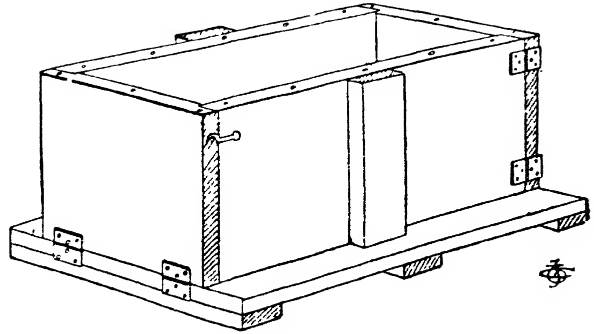


Fig. F.—Hinged Mould for Large Concrete Blocks, with its Sides Closed.

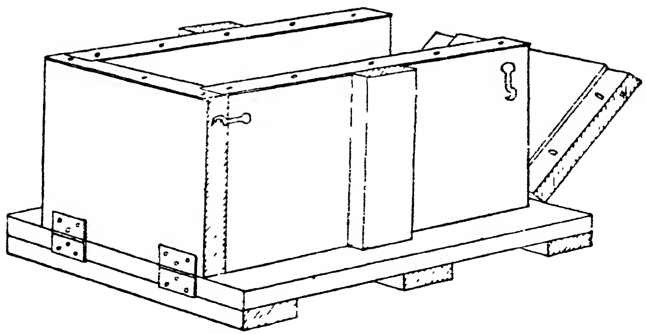


Fig. G —Showing Mould of Fig. F, but with One Side Open.

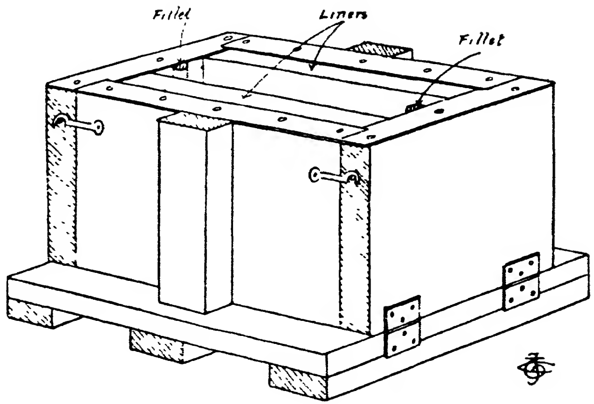


Fig. H.—Mould used for Blocks having Grooved Sides.

being provided to keep the sides in position when casting. The hinged sides enable the finished blocks to be taken out quickly. The casting-box shown in Fig. E is suitable for solid bricks of the usual standard proportions, e.g. 18 by 9 by 9 in.

When casting hollow blocks it is only necessary to place a wooden or metal core inside the mould, the shape, dimensions, and position of the core corresponding with the hollow portion of the block. In cases where grooves are required down the sides of the block, suitable projections or fillets are left on the inside faces of the mould (Fig. H).

By the use of liners, similar in principle to those shown in Fig. H, blocks of different shapes and sizes such as corner blocks can be made with a single mould. When a number of blocks have to be moulded it is best to use a multiple mould as shown in Fig. I. This illustration shows a mould for making twelve blocks at a time, but any larger or smaller number can easily be arranged for.

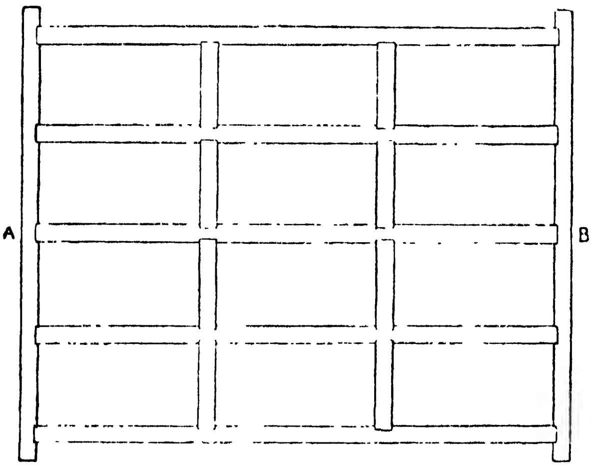


Fig. I.—Method of Moulding 12 Blocks at a Time.

When the concrete mixture has been well mixed it should be placed in the moulds within 20-30 minutes, as after this period it begins to set. It should be well tamped down so as to fill all the corners and spaces of the moulds. Tamping or ramming down should be done as each 2 in. to 3 in. level is filled with the mixture. Finally, when the mould is full, the surface should be levelled off with a flat board. When the concrete is sufficiently firm, namely, after an hour or so for a "dry" mixture, and 24 hours for a wet one, the sides of the mould may be lowered and the blocks removed. The blocks should be removed to a site where they are protected from sun, wind, and frost to set hard (6 to 12 days).

Concrete Wells.—Although the usual type of well used for water supplies, and also in connection with cesspool work, is made of bricks, mortared together, and cement faced, there is a good deal to be said for the concrete-tube type of well.

A number of concrete specialist firms now supply large-diameter concrete tubes, from about 1 ft. up to 7 ft. or 6 ft. in diameter of strong waterproof construction, in convenient sections of 3 ft. to 6 ft. (Fig. J).

The two ends of each section are tongued and fluted so that the adjoining sections not only register accurately in line, but give a strong joint when a suitable cement mortar is used.

The following are particulars of a few typical sizes of concrete tube [1]

Internal. diam.	Thickness. in.	Length. ft.	Weight. lb. per ft. run
1	1	3	50
2	2	3	170
3	2	3	315
4	3	3	590
5	3	3	690
6	4	3	970
7	4	6	1 300

These tubes will withstand a water pressure of 25 lb. per sq. in. for 24 hours without leaking.

In sinking a concrete tubular well, the first section is placed over the given site, and the soil dug from inside and underneath its lower edge,

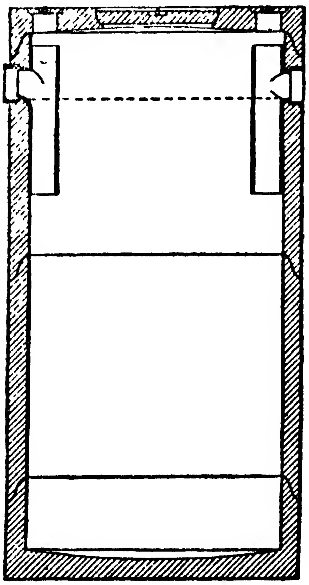


Fig. J.—Concrete Well built up with Parallel Sections.

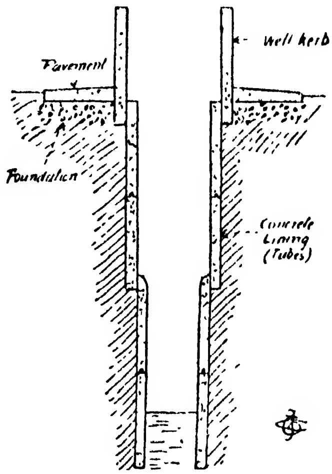


Fig. K.—Concrete Tubes used for Deep Wells.

when it sinks in virtue of its own weight, until it is flush with the surface.

Another section is then placed on the first, with the tongued and grooved parts in proper register. The joint should be cemented before placing the second tube over the first.

In the case of a water well, successive sections should be fitted as the digging proceeds, care being taken to ensure verticality; a plumb-line will do this. The usual depth for concrete linings is from 12 to 15 ft., below which the sides may be left of the strata material.

If the well extends to a considerable depth, tubes of successively diminishing diameter may be used from the top downwards (Fig. K).

The lower sections of the tubes should be perforated to allow the passage of the water from the strata around, into the well. If the well

[1] Sharp, Jones & Co., Parkstone, Dorset.

is not made with the special tubular sections described, it is necessary to brace the sides at short intervals to keep the earth from falling in.

A circular type of form, or core, some 3 ft. to 4 ft. in height and of a diameter 8 in. less than that of the dug well, is then lowered into position, and adjusted so that it lies concentrically, leaving a 4 in. space all round. The space is then filled with 1 : 2 : 4 concrete; but in order to allow the water to flow through, pieces of rod, pipe, or large stones should be forced into the concrete before it sets; this is only necessary below the water level. When the concrete is sufficiently hard to bear the heavy pressure of the thumb without indentation, the form can be raised 3 ft. or so, and another concrete filling applied; and so on until the whole of the well is lined. Finally the well head should be given a sloping concrete pavement about 3 ft. in width around it, and also a concrete kerb to keep mud, etc., out.

The usual well cover and pump connections can then readily be arranged.

Coke-breeze Building Slabs.—Coke-breeze concrete slabs are used chiefly for inside partitions of houses, for the inner walls, where the outer ones are of brick, and for outbuildings, walls, etc.

They are lighter and more porous than ordinary concrete, but are not impervious to moisture, unless the surfaces are grouted with cement wash or other waterproof coating. The ingredients of coke-breeze slabs in the best practice consist of Portland cement 1 part, sand 2 parts, and coke breeze 4 parts.

The coke breeze used consists chiefly of coke, well-burnt coal ashes, and pan breeze. It should not contain any unburnt coal, or partially burnt matter.

The breeze should be well sifted, and graded, the largest permissible particles being about ½ in.

Clinker may be used for the purpose, but it is not always recommended, as it is apt to contain deleterious materials. The slabs used for building purposes can readily be moulded by making wooden moulds having an internal shape corresponding to that of the finished slab. Fig. E shows a section through a wooden box suitable for moulding coke-breeze slabs. The recess R and projection P enable the slabs to be lined up when building walls, and at the same time ensure a tight, strong joint. The usual dimensions of solid breeze slabs are 18 in. by 9 in. by 4½ in., but thicknesses down to 2½ in. are used for light work.

The joints should be made with cement mortar consisting of 1 part Portland cement and 2 to 3 parts of sand. The mould shown in Fig. E enables the slabs to be cast vertically; by having several of these moulds blocks can be turned out by hand fairly quickly for domestic purposes.

In order to ensure quick removal of the finished slabs, the sides of the mould may be hinged, and hooks provided to hold them in position when pouring the concrete. With the usual 18 in. by 9 in. by 4½ in. coke-breeze

slabs a double wall can be built, the two portions of which are each $4\frac{1}{2}$ in. thick, and tied together across a cavity of 2, 3, or 4 in. width.

The face of the block may be left plain, but in the case of a machine-moulded product is more often left with an imitation stone effect, viz. with a rock face, a hammer-dressed face, or a tool-dressed face

Concrete, Coloured Patterns in.—Concrete floors, when required to be laid with a special aggregate, are usually laid *en masse* in the desired thickness, though when to be coloured a rough, coarse bottom layer is usually laid first, which, when firm enough, is topped with the coloured material. If it is desired to form borders with other colours, this procedure will prove satisfactory in this respect also, that the borders may be formed by placing $\frac{5}{8}$ in. thick slate laths upon the rough surface, which, after filling in with the coloured material and allowed a day to harden, are removed. Any pattern may be employed so long as one coloured aggregate is hard enough to allow the pattern to be removed before another coloured one is attempted. The material should be mixed rather stiff, because if mixed sloppy the excess water will, as the concrete consolidates, flow over that just laid and probably stain it. The pigments employed for cement colouring are oxides and umbers, such as English red oxide, brown, brown roasted iron oxide, brown ochre, yellow ochre, lamp-black, violet oxide of iron. Five per cent. by weight of colour to that of the current mixture should be the limit; over that may impair the cement.

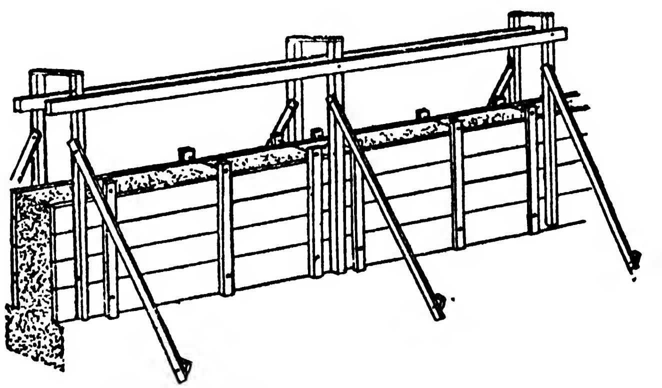


Fig. I.—Showing how a Wall is made by pouring Concrete between Parallel Boards, or "Shuttering" as it is termed.

Cement Wash.—Among the recipes for making cement washes which will stand exposure to the weather, perhaps none is cheaper or gives more satisfactory results than the following:

Mix together whiting or slaked lime and boiled oil to the consistency of cream. Mix separately Portland cement with water, and then mix the two together very thoroughly. Apply immediately after making, taking care frequently to stir the mixture during the operation. This cement will stand very well indeed if not made too thick. A certain amount of water is necessary to harden the cement, but it should not be applied during hot sunshine. Excessive absorption should be prevented by washing the surface with clean water a few hours before application.

Concrete Floor Dust Prevention.—Many workshop and garage users are troubled with the dust that arises from the concrete floor. Not

only does it make the car or place dusty and untidy, but, what is more important, it gets into working parts and causes undue wear.

There are several methods of preventing concrete floors from becoming dusty. Perhaps the simplest one is to spray the surface with old lubricating oil taken from the engine crankcase of the car; this binds up the surface and keeps the dust from forming.

Another method is to brush or spray the floor with a solution consisting of 1 part, by volume, of commercial hydrochloric acid and 8 parts of rain-water; this forms a compound with free lime in the cement which keeps moist and so stops dust from rising.

Perhaps the best method is to use a solution of silicate of soda, otherwise known as water-glass, in water in the proportions of 1 lb. of the former in each gallon of water. It is necessary to give the floor two or three coatings with this solution, allowing each coating to dry thoroughly before applying the next; drying takes place rather slowly, usually several days.

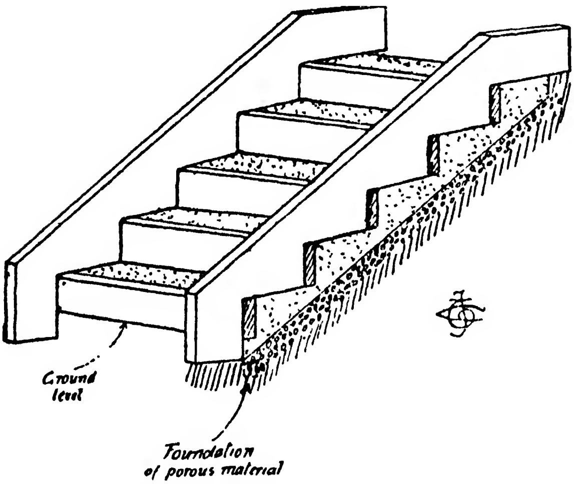


Fig. M.—Showing Method of making Concrete Steps.

The finished result, however, justifies the trouble, for a dustless surface—that can even be painted upon if desired—results.

Septic Tanks in Concrete.—The usual method of sinking wells for domestic sewage disposal where main drainage is not available is somewhat similar to that of sinking a water well, except that whereas the latter is porous at the lower end to allow the water to percolate through from the surrounding strata, in the former case the whole of the shaft is made watertight.

This necessitates a concrete base and cement rendering in the case of a brick-lined tank.

Alternatively a concrete-walled tank, with concrete base, can be used. The method employed is the same as that described under Wells, except that the lower wall is made solid and watertight.

A good method of making a circular septic tank consists in using large concrete tubes, with tongues and grooves or registers similar to that shown in Fig. J.

These tubes of rock concrete[1] can be obtained in any size from 2 ft. to 6 ft. diameter, and of any capacity. Fig. J illustrates the construction of a septic tank with rock-concrete tubes.

[1] Sharp, Jones & Co., Parkstone, Dorset.

Means of access to the dip pipes are provided in the cover, and in the larger sizes there can also be a manhole closed with a lid as shown in Fig. J. In the smaller sizes the whole cover can be removed. It is, however, only at very long intervals (5 to 10 years) that there will be any accumulation of sediment at the bottom of the tank, though the scum on the top, where the bacterial action occurs, will require removal at shorter intervals.

Cement Mortar.—This is used for strong brick and stone building work, and also for making it waterproof.

It is made of 1 part cement to 3 parts sand, but sometimes 1 : 2 proportions are used for very strong work. For weaker work in brickwork and masonry 1 : 4 is used. Too much sand makes the mortar brittle.

A quick-hardening mortar, that has no great strength but is suitable for many purposes, consists of 1 : 5 proportions, the mixture being well worked. To make it adhere properly, slaked or hydraulic lime is often added. This latter mortar is cheap, hardens rapidly, and obtains great strength on exposure to the air.

Concrete Hardening.—One of the modern ways of hardening stone or concrete is to apply a weak solution of magnesium fluosilicate, and after 24 to 48 hours (the time depending on the temperature) a solution of double the strength is applied. This treatment has been found very useful for dustproofing concrete.

CRAZY PAVING

Crazy paths, associated with old English architecture, have charms which are entirely their own. Composed of flat slabs of stone of ununiform size and shape, their artistic layout—when apparently they seem as though they had been put down anyhow—lend an enchantment to the scene that breaks the monotonous formality of those laid in squares or even in rectangular form. The careful selection of the materials of construction and the firmness of the ground work for its reception are the most important factors towards longevity, for surely a pathway composed of laminated or flaking stone laid upon a made-up site would very soon require renewing.

Suitable Materials.—In general practice the material obtained in the district is that which is employed, though there are firms who supply crazy stone of approved quality, colour and surface texture specially for this purpose. Sandstones as a class are hard and non-absorbent, but the individual quality depends upon the nature of the cementing material, for the grains themselves being of quartz are practically indestructible; a lack of cementing material in some stones causes them to flake when reduced to the form of flagstones. Colour also plays an important part in the general layout with sandstones; the colours range from cream, yellow, brown, to a bluish-grey tint.

The accompanying illustrations, Figs. A and B, show the method of making and laying concrete slabs to form crazy paving.

Though it may not be economical, it is certainly practicable to cast even various-sized slabs from the same mould by simply inserting wood division pieces. Many would prefer to break into pieces a newly made slab, made by simply laying some concrete upon calico or stiff paper and maintaining a thickness by placing the concrete between 2 in. thick battens or spars. Such slabs may be laid upon a special concrete foundation or upon a well-rammed cement and breeze foundation, bedding the pieces with semi-dry cement and sand. Consideration must be given as to whether vegetable growth is to be encouraged between the pieces, earth being placed as bedding and pointing instead of mortar when desired. Freeman's "Cementone Colours" are specially recommended as a colouring for such concrete work, though good effects may be obtained by means of a staining method using copperas of various strengths of dilution, according to the depth of colour required. The tool as per sketch no doubt will answer the purpose for the marking of joints upon a new concrete surface while still plastic, though it is general to use an S-shaped tool made from a length of ½ in. square iron, with the external angle downwards so as to form a V-joint. With this tool imitation tiles and borders and geometrical designs may also be impressed upon the still plastic surface. Concrete offers unlimited scope in the making of garden ornaments.

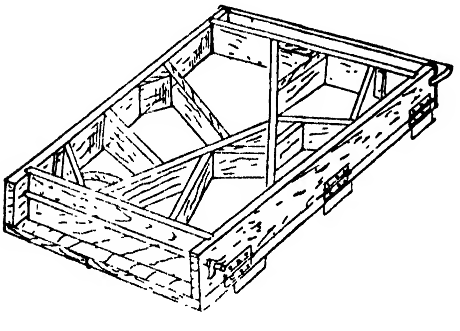


Fig. A.—Wooden Mould with Division Pieces for casting Concrete Slabs.

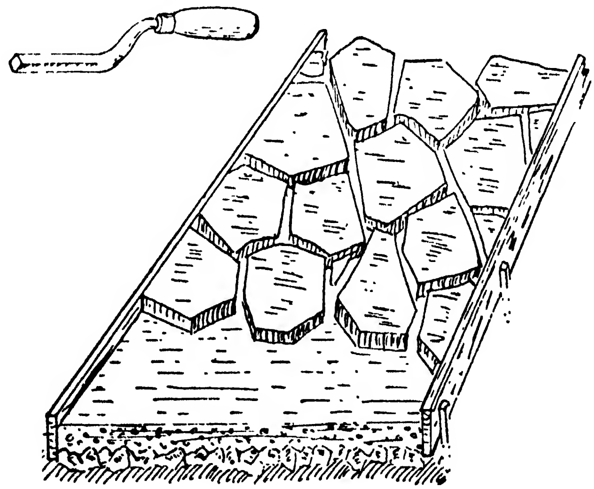
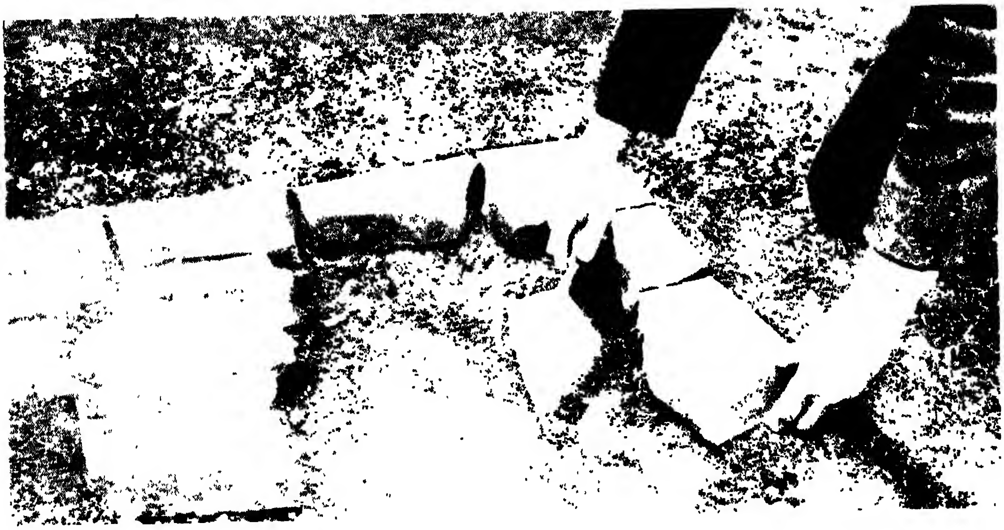


Fig. B.—Slabs cast from the Mould, laid upon a Concrete Slab. Above is shown a Jointing Tool for Crazy Work.

Laying the Stones.—Assuming that the site of the proposed path is of turfed land, the removal of the turf is the first essential, after which a careful examination and extermination should be made of any roots or fungi liable to affect the bed of the stones. In bedding the stones it may be sufficient for them to be laid with a mixture of sifted earth, ashes, or sand, though with stones with very uneven back a small percentage of clay should be used. Land of a somewhat loose nature should be prepared by rolling in



(1) The Outer Edges and Corners of a Paved Area are laid first, the Turf and Top Soil having first been removed. The Surface is covered with a Layer, 1 in. deep, of Sand.

(2) Bed the Pieces of Stone in the Sandy Layer, working the Sand well under the Stones, and tapping the latter together as shown above. The Sandy Layer allows the Stones to Bed to a Level Surface and discourages the Weeds growing through the Joints.

(3) A pleasing Crazy Path is made as shown, by cutting out the Turf and embedding thick Pieces of Stone in the Cavities thus made. e stones are laid below the Level of the s, a Lawn mower can be used over the Path.

LAYING CRAZY PAVING.

hard grit or ballast, eventually bedding the stones with a sand and lime mortar. This mortar would have an additional advantage in that it would kill many of the underlying roots, while still allowing small tufts to grow where required within the joints. The most disconcerting process is that of preparing a made-up site, and where it can be afforded a concrete reinforced raft should be provided wide enough at least to construct thereon a curb or, as may be, water channels, though it may be preferred to substitute agricultural drain pipes.

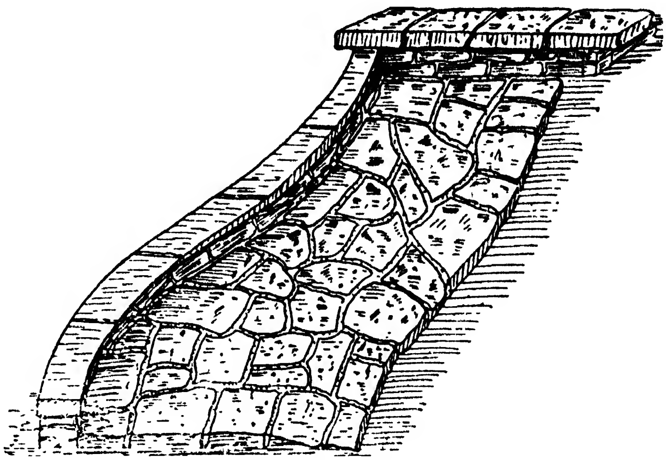


Fig. C.—Crazy Stonework Path.

Drainage.—The drainage of surface water is an important item with these paths, hence the reason why in some districts the joints are flushed up with a cement mortar and the surface cambered. Concrete paths newly laid may, as soon as the concrete becomes firm enough, be marked out to represent crazy stonework, though their general appearance is that of being very mechanical; slabs of broken-up concrete from old paths are much to be preferred.

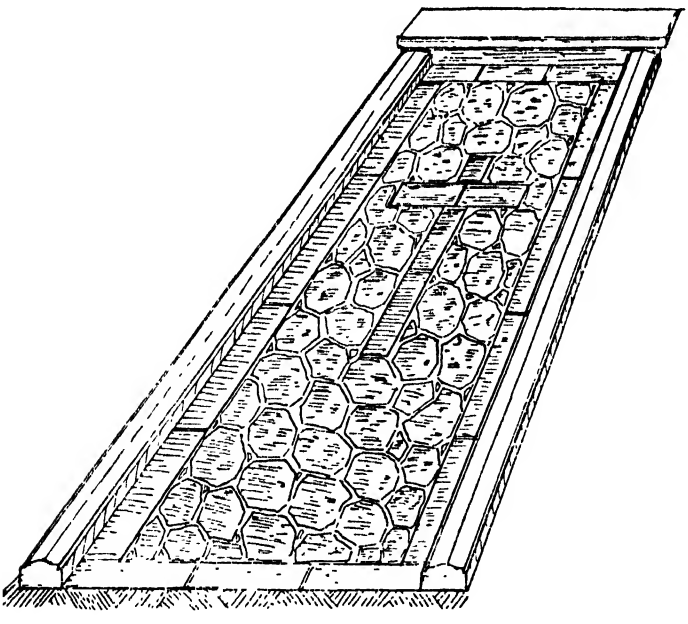


Fig. D.—Polygonal Ragwork Path.

Some Examples.—The illustrations show, Fig. C, a crazy path with almost a straight joint across the lower end, and also a continuous joint along the right-hand side. This is quite incorrect; binders and broken

joint make the ideal path. Fig. D, a pathway composed of polygonal ragwork with sandstone dressing and curbs, though these may be of cast

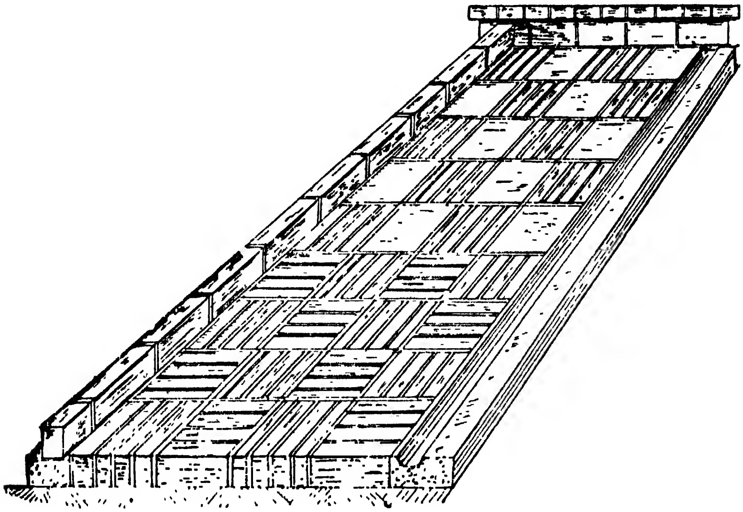


Fig. E.—Path of Red Pressed Bricks.

or run in sand-faced concrete. Fig. E is a pathway composed of red pressed brick laid on edge with brick curb and channel, either of which may be used, or both as desired. Fig. F is a pathway composed of cast

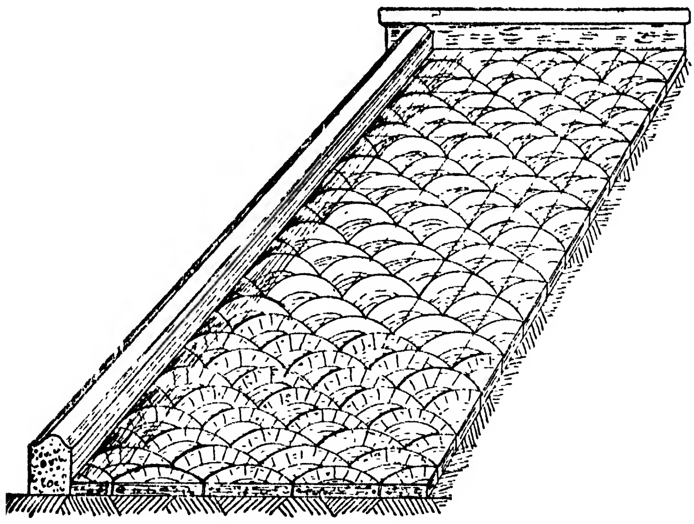


Fig. F.—Pathway of Cast Concrete.

concrete sections and run cement curb. As a final note, the method of driving wooden pegs into the earthwork and lining by means of boning rods (rough timber T squares) is essential upon work of any magnitude.

FLOOR, CONCRETE, COLOURED

A concrete floor to be coloured and to economise on the quantity of colour required should be laid in two operations, also for a floor of 16 ft. square it should be 3 in. total thickness. Mix ballast, $\frac{3}{4}$ in. crushed whin or crushed brick in the proportion of $3\frac{1}{2}$ parts of the aggregate used with 1 part of cement; 3 parts of the aggregate with $\frac{1}{2}$ part sand may be used if found to be too coarse. This mix is laid to 2 in. thick. The surface, though straight, should be left rough. This can be done by tamping the straight-edge all over the surface. Allow this at least twenty-four hours to set. "Pudlo" may be used as a waterproofing agent, and must be added to the dry cement first, mixing it through by sieve, 3 per cent. or, say, $2\frac{1}{2}$ lb. of "Pudlo" to each bucket of cement. Mix $\frac{1}{4}$ in. granite chippings containing a fair proportion of fine granite sand, $2\frac{1}{2}$ parts, to 1 of the "Pudlo" cement. Add 2 lb. red oxide, mix the lot well together when dry, and wet up into a plastic condition. When laid and begun to set, by means of planks placed across or by kneeling upon boards, this floor may be polished quite smooth.

How to Paint Concrete.—For colouring concrete care is necessary in selecting colours. Venetian red and Indian red should never be used, because they are heavily loaded with calcium sulphate, which often causes the cement to disintegrate. Red hematite, some red ochres, and many others of the iron ores, particularly if burnt, are safe and suitable. Red hematite has a powerful effect, very little being needed. Yellow ochres are suitable and safe, and have considerable colouring power, according to a recent report of the Concrete Institution; but there seems to be some doubt on this point, as other authorities consider that yellow ochre reduces the strength of the concrete considerably. Burnt umber is safe, and gives an agreeable warm colour. A satisfactory colour has been found in green, but not blue; copper arsenide gives a fair green, but it is not desirable, and ultramarine is unsafe. There is one green colour on the market that will not fade when mixed with cement and exposed to the light and the weather.

It is not possible to get a clear black, but black oxide of manganese is probably best. Ground hard, burnt coke may be used, but it is not so good, while ground coal and lampblack are quite inadmissible, except with some of the anthracite coals. Carbon blacks are preferable to lampblacks, because they do not have the same tendency to float to the top during mixing. In addition, common lampblack is apt to run and fade It is interesting to note that for the removal of the glare in concrete sidewalks there is an ordinance in the city of Los Angeles, as in San Diego, to incorporate a colour to remove this glare. A black has been used, as the greens are not permanent, while a proper black is unaffected by the sun's rays.

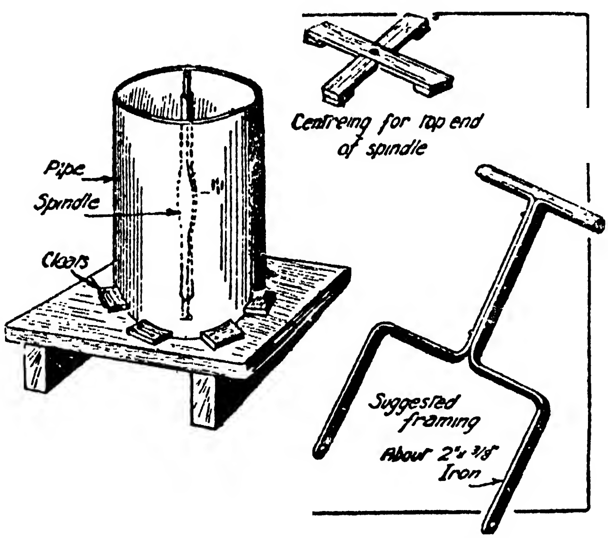
A clean white is not obtainable except by using a white cement; but a near approach may be obtained by the use of slaked lime with a

little yellow ochre. Chalk and whiting do not give a very satisfactory result.

Mixing the Colours.—Except where slaked lime is used, the colour in sufficient quantity to give the desired tint should always be mixed (preferably ground) with the dry cement before any sand or water is added. This mixing must be thorough, so that the mixture is uniform in colour. After mixing, the combination should be treated in the same way as ordinary cement. It is well to note that the wet mixture should be several shades darker than that finally required, as the wet mortar looks darker to the eye than it really is. Hand mixing is not satisfactory. Slaked white lime should be freshly made, but perfectly slaked, and should be mixed with cement and aggregate at the time of using.

GARDEN ROLLER IN CONCRETE

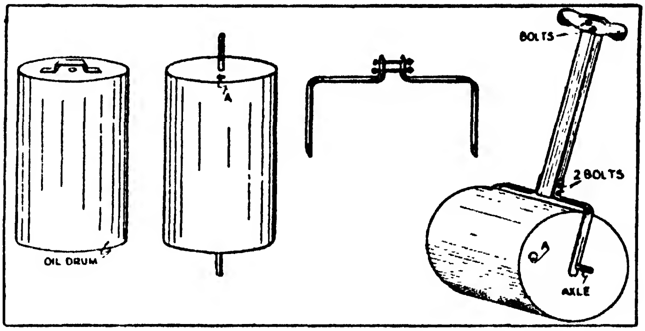
Concrete rollers are usually cast from a wood cylindrical form, and as it acts as a deterrent to those who would care to make their own, it is now suggested (as it has been proved to be practicable) to cast it and be integral with a drain pipe of the desired diameter outside. These pipes often arrive by truck with one or two damaged at the socket end, and may be selected for the particular purpose at any builder's yard or that of a builder's merchant.



Details of Concrete Roller Construction.

The remainder of the socket may be quite easily cut off by using a tool with a horizontal flat blade, such as a bricklayer's hammer or a boiler chipper's handpick.

The Axle.—The axle, which must be cast in, may be of 1¼ in. square iron bar, with turned ends and with a bulged centre piece, to prevent the probability of its sliding out. Fix up a stout board of about 2 ft. square, and mounted upon battens, and with a hole for the axle end. The pipe being cut ready for use, place it centrally with the hole and secure it in position by means of wood cleats nailed to the board and outside of the pipe. Next place the axle end in the hole, and while in a perfectly vertical position, secure it by means of wood braces until the concrete has set hard. It must not be forgotten that the board must be set perfectly level. The roller, to be 3 ft. long and 500 lb. in weight, will be of a diameter approximating 15 in.



Alternative Method of making Garden Roller, by filling a 10-Gallon Oil Drum with Concrete.

Preparing the Concrete.—Granite chips as an aggregate, mixed as 4 parts granite, 1 part of sand to 1 part of Portland cement, would make an ideal mixture, which should be used in stiff plastic condition. As no reinforcement is necessary, it is now simply a matter of placing in the concrete, tamping it meanwhile to consolidate it until it is level with the top of the pipe. In this state it is left four or five days to harden, when it may be turned on to its side to remove the board, and, of course, to fit on the handle.

GARDEN SEAT IN CONCRETE

There are considerable possibilities for the use of concrete in the garden, for it is easy to make and cast into shapes, and is inexpensive. A simple piece of concrete construction is shown in Fig. A, consisting of a seat formed with a plain slab on two shaped supports. As it is possible to colour the concrete, the seat need not be stone colour when finished, but stained to suit any colour scheme.

The dimensions of the seat are given in Fig. B; the dotted lines indicate the position of the supports and also the iron rods used for reinforcing the material.

Making the Moulds.—It will be necessary to prepare two moulds, one in which to cast the top slab and the other for the supports. A plan and section of the mould are shown in Fig. C, the first stage being a plain shallow box of 1 in. thick wood. Prepare two sides, each 3 ft. 8 in. by 2½ in. by 1 in., and two ends, 15 in. long, and the same width and thickness. Screw the ends to the side to make a framework, and then screw on a bottom, which may be less than 1 in., but should not be less than ⅝ in. thick. If this box were filled with concrete, the result would be a perfectly plain slab, 3 ft. 6 in. long, 5 in. wide, and 2½ in. thick. The slab we wish to cast has chamfered edges, and is provided with two hollow places underneath to receive the top of the supports. To form the chamber, it will be necessary to prepare some lengths, triangular in section and ½ in. side. These pieces should be nailed to the sides, the ends being mitred to form neat joints. To form the recesses, two 10 in. by 2½ in. by 1⅛ in. strips should be nailed to the bottom, 6 in. away from the ends.

The finished mould, with a portion of the top triangular portion removed, is shown in Fig. D, with the addition of the iron bars; these are

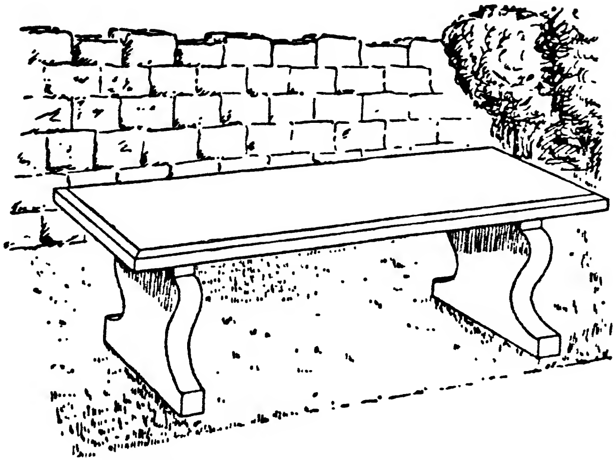


Fig. A.—A Concrete Garden Seat.

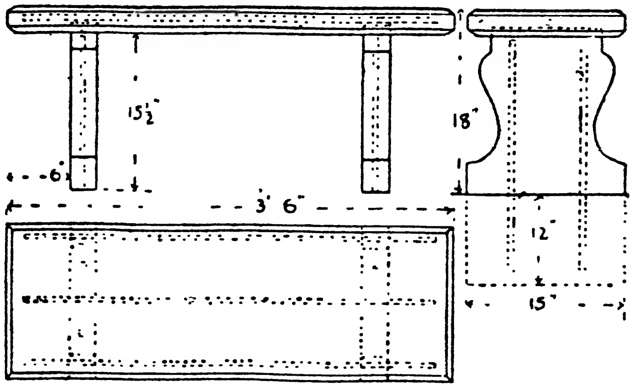


Fig. B.—Dimensions of Concrete Seat.

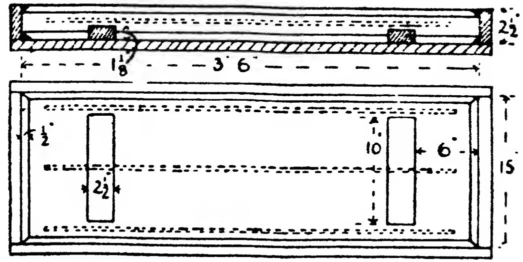


Fig. C.—Plan and Elevation of the Mould.

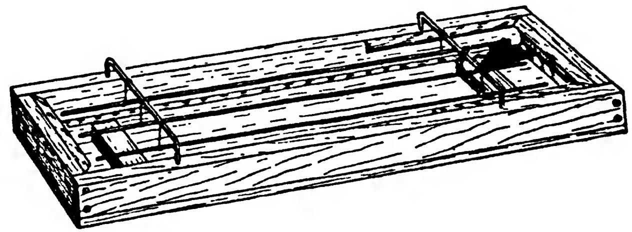
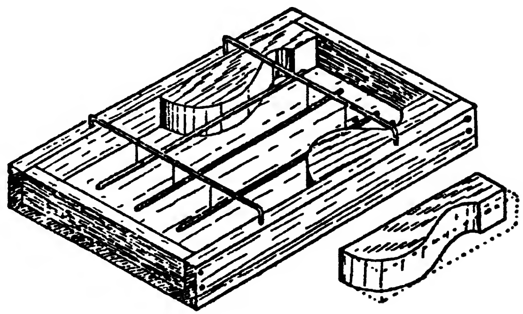


Fig. D.—How the Mould is made.



Figs. E and F.—Mould for Supports.

about 3 ft. long, $\frac{3}{8}$ in. diameter, and are supported by wires or string tied to two bars let into the top edges of the frame, so that they are just above the top of the two inner blocks.

The mould for the supports is shown in Fig. E, and consists of a plain box made with two 2 ft. 6$\frac{5}{8}$ in. by 2$\frac{1}{2}$ in. by 1 in. sides, and two 15 in. by 2$\frac{1}{2}$ in. by 1 in. ends; these are screwed together and a bottom attached. The shape of the support is obtained by fitting in two shaped blocks; these are cut from pieces of wood 14 in. by 3 in. by 2$\frac{1}{2}$ in. as in Fig. F.

Preparing the Concrete.—The concrete for filling the moulds should be composed of 1 part Portland cement, 2 parts sand, and 4 parts coarse material. The sand should be clean, sharp, and pure, and the coarse material, known as the aggregate, may be gravel, crushed granite, or stone. A good material, if it can be obtained locally, is marble chippings. Broken brick can also be used. The concrete should be mixed on a clean level floor or a mixing-board composed of boards nailed to suitable battens. It is also necessary to have a small box, measuring about 1 ft. each way, and 6 in. deep, so that the material can be measured out accurately. Proceed with the mixing by measuring out the proportions of sand and spread it on the mixing-board, cover with the requisite amount of cement and mix the two together with a spade. When thoroughly mixed, add the coarse material and mix up again. Water is now poured on a little at a time from a rose attached to the end of a watering-can, the material being well mixed together until it will just run off the spade. It is now poured into the moulds and tamped down to make sure that every part of the mould is full, when it can be left to harden, but covered with sacking to prevent it drying too quickly. When quite hard, unscrew the sides of the moulds, and then the slabs are ready for erection in the desired position.

PATHS AND TILES, CONCRETE

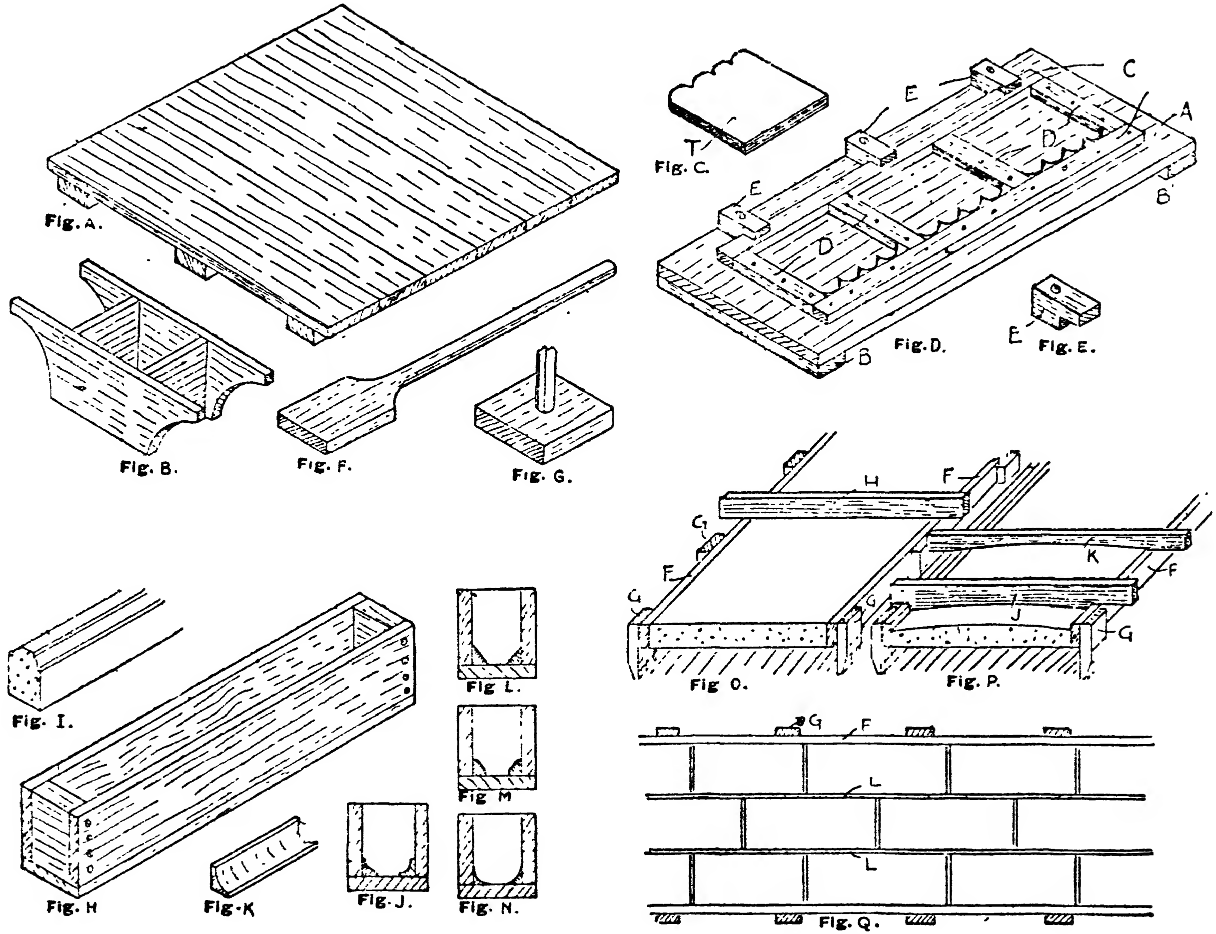
Concrete, on account of its cheapness and durability and the ease with which it can be made, forms an admirable material for use in the garden. It is suitable for fencing, curbing, pavements and paths, as well as for more ornamental features such as seats, sundials, and bird baths. Concrete is made from Portland cement, sand and gravel, broken stones or other materials, including coke breeze; these are mixed in varying proportions depending on the kind of work to be done. For general garden use, in the making of paths, curbing, or seats, etc., the usual proportions are 1 part of cement, 2 parts of sand, and 4 parts of coarse material, known as the aggregate. Suitable aggregates are gravel (such as Thames ballast), broken granite, crushed stone, marble chippings, etc., but broken brick, coke breeze, and broken clinker are useful for many purposes.

Concrete should be used within about half an hour after being mixed, so that only just the amount required for the particular job in hand

should be mixed at one time. It is quite possible to estimate even small quantities of concrete by finding the number of cubic feet or yards in the finished work; for example, a garden path 12 yards long, 1 yard wide, and 3 in. deep would measure exactly 1 cubic yard. An 8 ft. length of 6 in. by 3 in. curbing would measure 1 cubic ft., and 72 ft. of it would equal 1 cubic yard. For 1 cubic yard of concrete in the proportion of 1—2—4, 520 lb. of cement, a little more than $\frac{2}{5}$ cubic yard of sand, and $\frac{4}{5}$ cubic yard of shingle or gravel would be required.

Concrete Mixing.—The mixing of concrete should be done on a mixing-board, as shown in Fig. A. This should be at least 4 ft. square, but a larger board is better. A bottomless measuring box should be provided; one measuring 12 in. each way, as shown in Fig. B, will take one cubic foot. This is placed on the board, filled up, and when lifted up will leave the cubic foot of material on the board. Begin the mixing by measuring the required quantity of sand, and then spread it out to a depth of about 4 in. Next measure out the necessary amount of cement and spread it evenly over the sand. These two materials are now thoroughly mixed together with a spade, moving it from one side of the board to the other, and allowing the dry material to run off the spade so that the particles of sand and cement are well mixed together. Move the material to the other side of the board again and repeat if the colour of the mixture is not uniform. Now spread out the material and add the required amount of aggregate and turn it over at least three times to make sure that the whole is mixed. (Porous material such as coke breeze should be wetted before being measured out.) It is impossible to estimate the exact amount of water required to wet the mixture, but the water should be poured on the material through the rose of a watering-can, or otherwise sprinkled. Mix it up with a spade, and for general use the material should cling together, and pour off the spade easily without being too liquid.

Making Concrete Tiles.—We will now suppose that edges of a garden path are to be tiled, and the first thing to do is to provide strips of wood, secured to a board, to give the shape of the tile as in Fig. C. A suitable mould or form for three tiles is shown at Fig. D. It consists of a baseboard A supported on battens B to prevent warping when damp. Two long strips C and four short strips D are cut out to about $1\frac{1}{2}$ in. wide and a thickness equal to the thickness of the tile, and these are screwed down to the board, but at least one of the long pieces should be held in position with cleats E, as at Fig. E. The curved top may be made with bent strips of tin. The concrete is now poured into the moulds and the material tamped, that is, worked with a wooden stick or block, as at Figs. F and G, to exclude air bubbles and to make sure that the material fills the mould entirely. The concrete should be prevented from drying too quickly, and should be covered with wet sacking for a few days.



Tools and Moulds used for making Concrete Paths and Tiles.

Concrete Curbing.—For the construction of curbing for the garden edges, it will be necessary to make a wooden mould, as in Fig. H. This should be about 3 ft. long, 6 in. deep, and 3 in. wide, but a less depth can be used if desired. To make a curb as shown in Fig. I, the two inner corners should be filled in with moulding, as in Fig. J, a portion of the moulding, which should be about 1 in. wide, being shown in Fig. K. Other shapes for the top are shown in the sections in Figs. L, M, and N. The method is just the same as for the tiles, and when the concrete is dry the lengths will drop out of the mould. Should there be any difficulty about this, the sides may be unscrewed.

Garden Paths in Concrete.—Ordinary garden paths are made as shown in Fig. O; the first thing to do is to place strips of wood to limit the width of the path; these strips should be held in position by pegs, as shown in F and G. A sound foundation should be made with broken brick or gravel well rammed down, and then the concrete spread over to fill up the space. When it has been well tamped down, the surface is finished with a levelling stick, as shown at H. To provide a smooth path, the concrete should be filled to within ½ in. of the top of the side strips, and after the work has dried out somewhat, a covering of cement and sand in the proportions of 1 to 2 should be poured on and levelled with the stick. The method of working a cambered path is shown in Fig. P; the first layer is shaped with a stick, as at J, and the final layer, made as plastic as possible, shaped off with a stick shaped as at K (Fig. P).

A pleasing method of forming a path is to fit strips of narrow wood between the side strips G and F, as shown at L in Fig. Q. The narrow strips can be removed later if desired, and the space filled in with a coloured cement and sand mixture. To obtain a coloured concrete, it is necessary to mix the colouring matter with the cement before it is mixed with the other materials. For red, use 14 parts of red oxide of iron with 86 parts of cement; for yellow, 12 parts of yellow ochre to 88 parts of cement. Blue is obtained by adding 14 parts to 86 of cement. Green by using 10 parts of oxide of chromium to 90 parts of cement. The same proportions with black oxide of manganese or any carbon black instead of chromium will give a good black.

SAWDUST CONCRETE

Sawdust can be used in place of stone ballast in concrete and forms a kind of artificial wood which, moulded with different pigments, gives a variety of coloured stone effects. It makes excellent blocks for floor tiles, electric light fittings, panels, etc. The moulded product can be worked with woodworking tools.

A good composition is as follows:

Portland cement, 1 part by volume
Fine Sand ... 2 parts
Sawdust ... 4 „

Mix well and then add water gradually, whilst turning the mass over

constantly until a thick pasty consistency. The mixture should then be transferred to well-greased moulds.

SAWDUST MORTAR

Sawdust used in place of hair in mortar is stated to prevent its peeling off. The sawdust should first be dried thoroughly and sifted through an ordinary grain sieve to remove the larger particles. The mortar is made by mixing 1 part cement, 2 parts lime, 2 parts sawdust, and 5 parts sharp sand. The sawdust is mixed dry with the cement and sand.

SECTION 5

ELECTRICAL AND RADIO

ACCUMULATOR CHARGING BOARD

The following notes are intended to assist those who wish to charge their wireless or other batteries from the electric supply mains:

A 230 volt, 32 c.p., carbon filament lamp takes about 0·4 amp. A 60 amp.-hour battery requires 6 amps. for charging; therefore 15 lamps are necessary to pass the current. Fig. A shows the wiring diagram for a board having 19 lamps, which allows 4 lamps as margin, and to make up for the back e.m.f. of the batteries. Any number of lamps, from 1 to 19, can be switched in, giving a range of current from 0·4 amp. to the maximum. The diagram is drawn for a supply of 230 volts. If a 460 volt supply is used, then each lamp must be replaced by two 230 volt lamps connected in series as shown in Fig. B, i.e. 38 lamps will be required in all. Fig. C shows the wiring diagram for a 230 volt board using a wire resistance, the coils of which are connected to the studs of a dial switch for easy current regulation. From left to right the coils have resistances of 230, 77, 38, 39, 18½, 11½, 8, 9, 29 ohms respectively, giving a current range of ½ to 8 amps. The first four coils are of 23 S.W.G. Eureka, the lengths of wire being 87, 29, 14½, 15 yards, and the remaining five coils are of 18 S.W.G. Eureka, the lengths of wire being 28, 17½, 12, 13½, 44 yards. Manganin wire of the same diameters can be used, but then the lengths must all be increased by 10 per cent. If a 460 volt supply is used the length of wire in each coil must be doubled. If no current of less than 1 amp. is required, the first coil can be cut out, and if it is never required to be less than 1·5 amp. (i.e. the smallest cell to be charged is 15 amp.-hours), then the first two coils can be dispensed with, thus saving a considerable amount of wire. The coils should be mounted so as to allow air freely to circulate through them for cooling—expanded metal or stout wire-netting should be used for protection.

On either board a push (not a switch) should be placed in series with the voltmeter to prevent the latter from being left connected when no batteries are being charged, as in that case the instrument might receive the full mains voltage across its terminals. Single 0·048 or 3/·029 V.I.R.

should be used for the wiring. The board itself should be of hard wood. The amounts of materials required are obvious from the diagrams.

L.T. Battery Charger.—The charger is quite simple to construct, is permanent, and works very satisfactorily. It uses one of the copper and copper oxide rectifying units made by the British Westinghouse

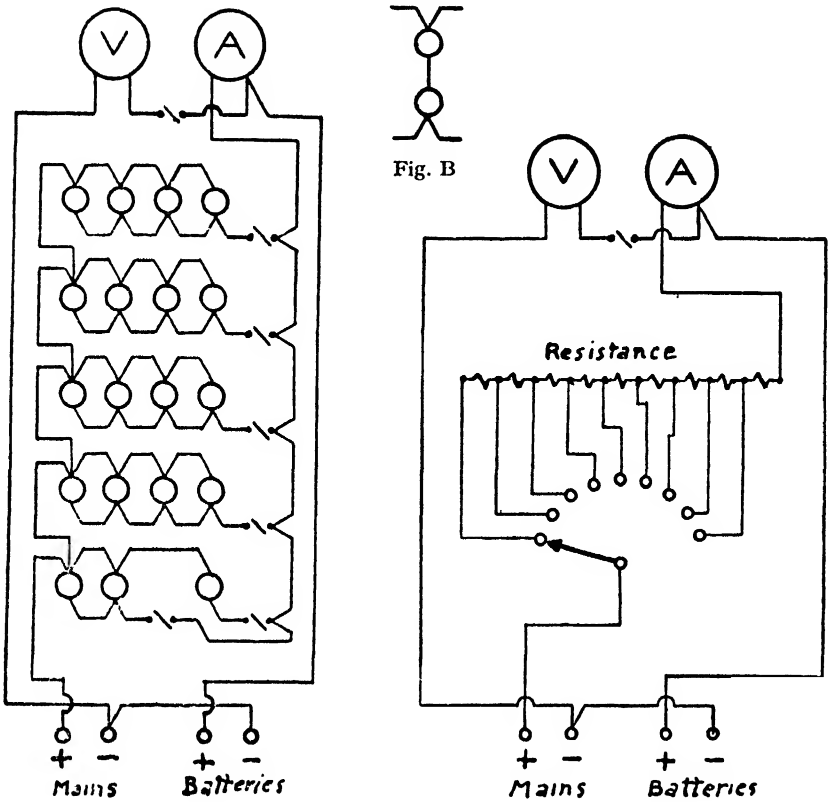


Fig. B

Fig. A

Fig. C

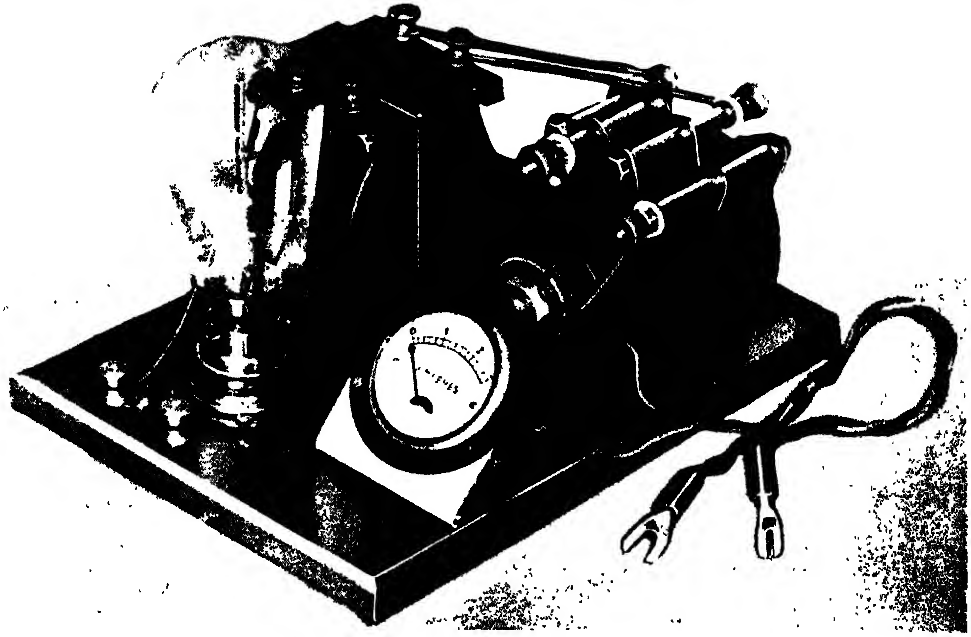
Wiring Diagrams for Accumulator Charging Boards.

Company, and known as the A.3 Type. This unit has four terminals, two marked A.C. and the others "Plus" and "Minus."

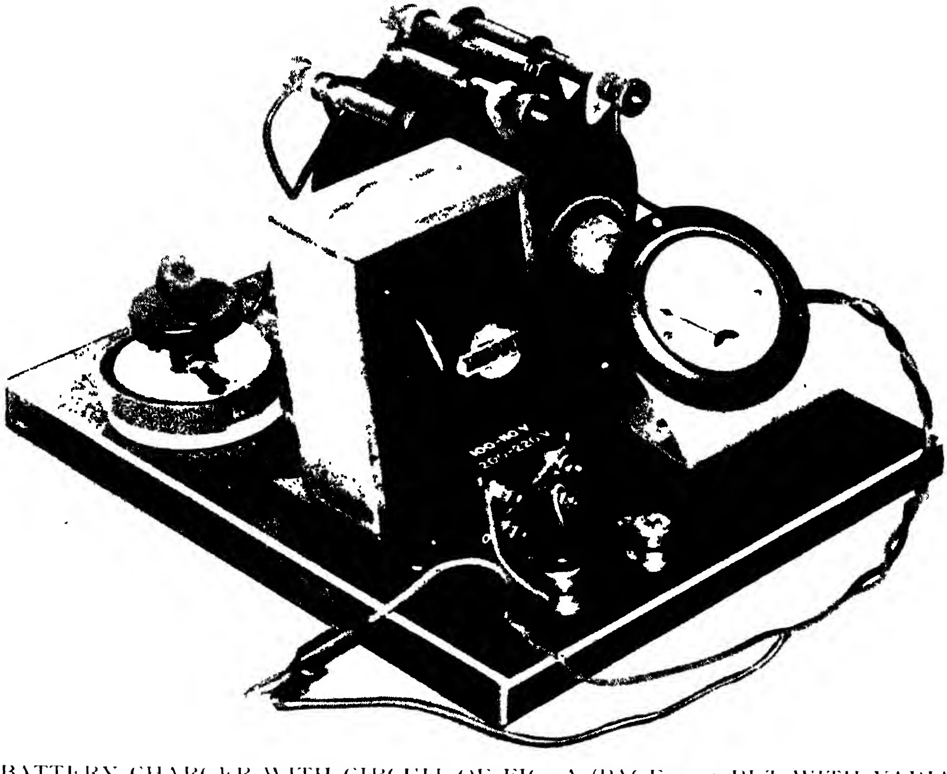
As these units are designed to take about 8 to 9 volts at the most, the A.C. supply from the lighting circuit must be stepped down to this amount by means of a suitable transformer.

A spare 110 volt to 8 volt transformer is used on the 220 volt mains supply by placing a 110 volt lamp (shown at L in Figs. A and B) in series with one lead. From the output side of the transformer the stepped-down A.C. current is led to the A.3. rectifier as shown.

An ammeter reading to 3 amperes, greatest value, is connected in one of the leads on the direct current output side of the rectifier.



BATTERY CHARGER MADE TO CIRCUIT IN FIG. A (PAGE 243



BATTERY CHARGER WITH CIRCUIT OF FIG. A (PAGE 243) BUT WITH VARIABLE RESISTANCE INSTEAD OF LAMP TO REGULATE CURRENT.

The current obtained from these units is about 1 to $1\frac{1}{2}$ amperes at about 8 or 9 volts, and so is suitable for charging up wireless accumulators.

There should preferably be a 10 ohm variable resistance between the transformer and rectifier, shown at X (Fig. A), but 110 volt lamps of different wattage may be used in the A.C. supply lead at L (Figs. A and B).

The charging units were mounted on a deal board about 8 in. by $6\frac{1}{2}$ in., so that the charger was very compact.

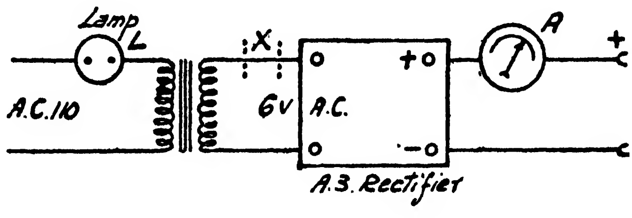


Fig. A.—Circuit Diagram for Battery Charger.

No doubt by using a 220 volt step-down transformer, and a 10 ohm variable resistance, a better variation of the charging current can be obtained.

When choosing your resistance, see that it is made to take a current up to 2 amperes, for the usual wireless rheostats will not take more than about half an ampere.

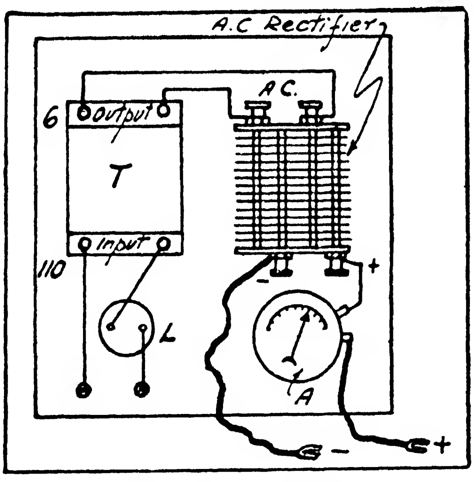


Fig. B.—Diagram of Wiring Connections.

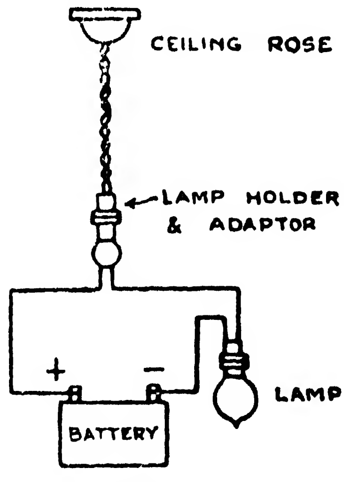


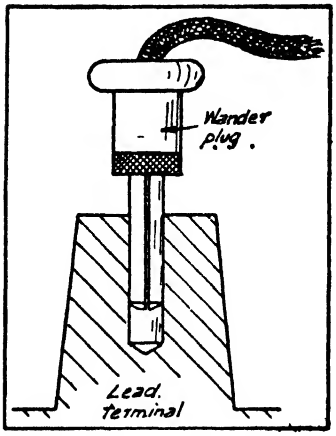
Fig. C.—Showing how to charge a Battery from D.C. Lighting Circuit.

When charging, this unit gives the usual mains hum, so that if used for an L.T. battery eliminator suitable chokes and condensers would have to be fitted.

The accompanying diagram (Fig. C) shows the method of charging a battery from a D.C. lighting circuit.

The lamp, preferably with carbon filament, should be so chosen that the charging current is correct in value.

Charging Car Batteries at Home.—Wireless constructors who are also motorists sometimes have to keep their car batteries charged when the car is laid up or when a lot of night driving has been done.



Charging Car Batteries.

It is difficult when using the ordinary wireless battery type of chargers to make proper connections of the charging leads to the usual tapered lead terminals of the car battery, and to make tapered special clips may prove a difficult job.

The writer got over the difficulty very effectively and quickly by drilling a $\frac{1}{8}$ in. hole, to a depth of about $\frac{1}{2}$ in., in each of the tops of the two plus and minus lead terminals of the car battery. It was then possible to use the ordinary high-tension battery type of wander plug for connecting the battery with the charger, as shown in the sketch.

The same scheme can be used for taking a lead or a pair of leads from the car battery to operate an additional light in the car without having to disturb the main cable connections.

ACCUMULATORS, CARE OF

A new accumulator should be filled with sulphuric acid and water mixed by pouring, gently, the acid into the distilled water and stirring The correct acid density, which should be ascertained by a hydrometer should lie between 1·250 and 1·300. The accumulator must be given a slow first charge at about one-half of its rated current charge. When fully charged an accumulator should show an acid density of 1·250 or 1·300. When fully discharged, this drops to about 1·150. The cell voltage immediately after fully charging is 2·6 to 2·7, but this drops to 2·15 to 2·00 volts per cell as soon as current is taken from the accumulator

A fully charged battery will have *positive* plates of a *dark chocolate brown colour* and *negative* plates of *grey lead colour.*

If the plates show white sediment deposits, as after standing for long periods uncharged, this is a sign of *sulphation* and in many cases the accumulator loses its efficiency and will not then hold its full charge.

Accumulators should have the *acid level* maintained, if necessary, by adding distilled water until there is about $\frac{1}{8}$ in. or so of liquid above the tops of the plates, in order to make up for evaporation during charging and ordinary usage.

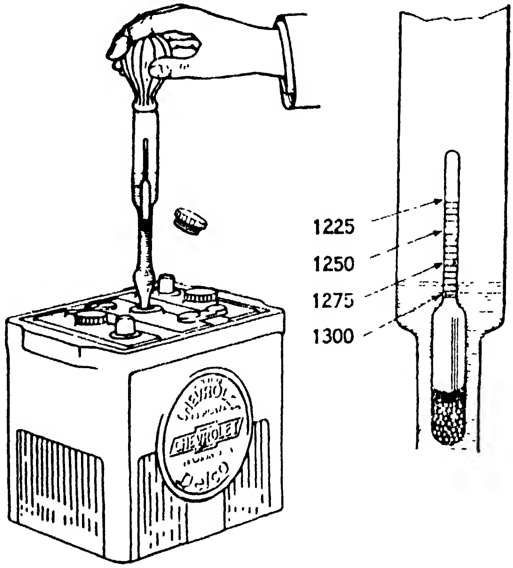
Periodically, say at yearly intervals, the sediment which accumulates at the bottom of the cell containers should be removed, as otherwise it may short-circuit the positive and negative plates, thus causing discharge. To remove the sediment, empty out the acid and wash out with distilled or clean rain-water (followed by a final rinsing with distilled

water) until no trace of sediment can be observed. Then refill with fresh acid of density 1·25 to 1·30 and re-charge.

Keep the brass terminals clean and give a smear of vaseline to prevent corrosion by any acid which may reach the terminals; the terminals should always be kept tight.

Always keep an accumulator or car battery fully charged, when not in use, since a discharged battery deteriorates, if left for any appreciable period.

If an accumulator is *to be stored* it should be fully charged and then at intervals of 4 to 6 weeks given a short charge to maintain the acid density at its correct value.



Checking Accumulator Acid Density with an Hydrometer.

Alternatively, after fully charging a battery, it should be allowed to stand for a few hours, and the acid then run out into a jar or bottle. The battery is then refilled with distilled water and a lamp of suitable voltage placed across the terminals until the battery voltage reads 2·0 volts at each cell terminal. The water is then run out and the vents removed. The battery is next turned upside down to drain off surplus moisture and the vents replaced. After storage, the cells should be refilled with acid of 1·25 to 1·30 density and recharged. The brass terminals should be wiped over with a rag saturated in washing-soda solution, in order to get rid of any acid. After drying they should be well coated with vaseline, to prevent corrosion during storage.

AERIAL FRAME, FOLDING

One drawback of the ordinary frame aerial is that it is awkward to move about, more especially if one has to carry it in a car, or from the house to the garden. The collapsible type is much more convenient to transport and, as the illustrations show, it can be made more easily than some rigid frame aerials.

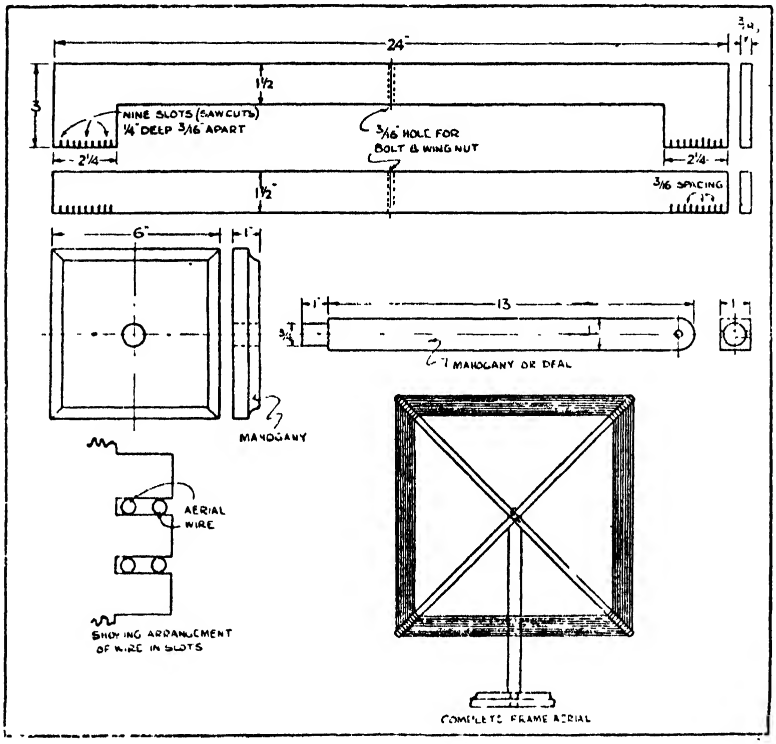
The dimensions of the members are given in the sketches, and it will be seen that the aerial wire is wound on a frame consisting of two specially shaped flat pieces of mahogany, oak, or other suitable wood. The aerial wire is wound into slots cut into the four ends of the two arms.

Regarding the aerial wire, this consists of about 90 ft. of 18 s.w.g. silk-covered copper wire wound in two sets of nine layers each.

A thin strip of ebonite or fibre is used to cover the open ends of the

slots connecting the wire, so that when the cross-arms are folded the wire does not come out of the slots. It can be arranged to commence and to finish the windings on the same end of the same arm, so that the two terminals can be arranged fairly close to one another.

The aerial wire should not be wound too tightly, but if anything a little on the loose side, to permit of folding the two arms without injury



Construction of Folding Frame Aerial.

to the aerial wire; the sides of the slots should be rounded a little to assist in the folding operation by permitting the wire to run easily through the slots. Quite a simple stand can readily be contrived to carry the frame, as shown in the illustration above.

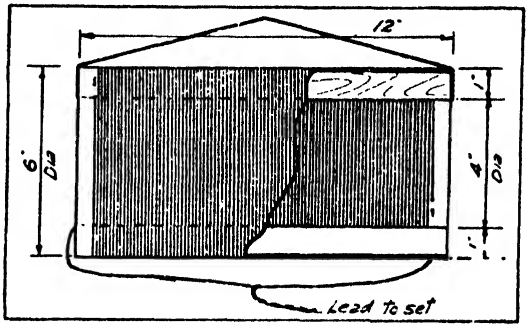
AERIAL, INDOOR

With modern wireless receivers a short aerial of some 20 to 30 feet length, only, is needed. This can consist of ordinary bell wire and can be arranged behind the picture rail, out of sight, except for the down lead to the wireless set's aerial terminal.

Another method is to use the white adhesive tape type of aerial, having a metal wire inside. This tape can be stuck around the wall just above the picture rail and if the wall is white above the latter the tape will be almost invisible. When indoor aerials are used the bare metal should not

touch any large metal objects, such as the curtain rails, metal window frames or radiators.

The indoor aerial can also be made by running a length of 40 to 80 ft. of plain or insulated wire (such as bell wire) around the top of the picture rail. If possible insulating pins should be used as the walls of a house are really "earthed." A good indoor aerial can readily be made from a coil of 16 gauge copper wire, 100 ft. long, wound to a helical diameter of 8 to 12 in. just like a spring, and stretched across the room.



Indoor Aerial Device.

The aerial illustrated has produced results better than an outdoor aerial when tested side by side.

As seen in sketch, the aerial consists of two cardboard formers, one inside the other, the outer 6 in. diam. and the inner 4 in. diam., each 12 in. long; 100 ft. of fine covered wire is wound as shown. Start $\frac{1}{2}$ in. from one edge, fasten end of wire through a hole, and wind the wire evenly and tightly on until the other edge is reached, when the wire is threaded through another hole and about 8 in. pulled through.

The winding of the next coil is started from the opposite end. Continue as before, and thread 8 in. of wire through hole $\frac{1}{2}$ in. from edge and join to the other wire. A wire joined here forms the main lead to the set. The inner coil is spaced exactly 1 in. from the outer coil with pieces of wood or string. With a length of string to hang the coils up, the aerial is complete.

The aerial should be tried by hanging it up in several places till the best one is found.

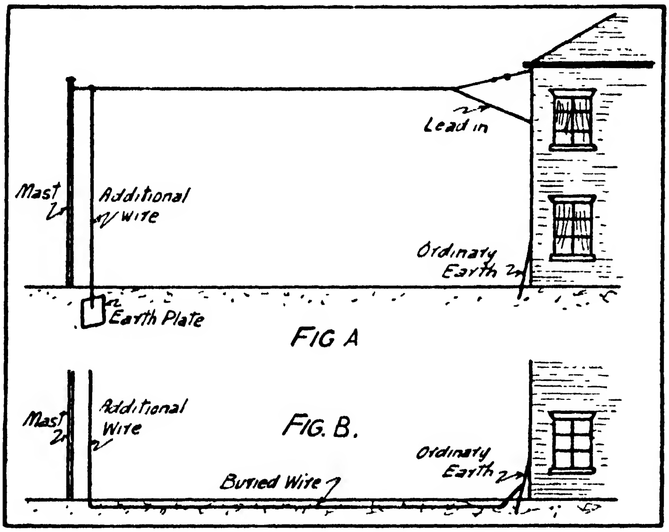
AERIAL MASTS, CARE OF

It is now some years since wireless broadcast reception became a common feature of the domestic household, and during the intervening period some hundreds of thousands of wireless masts must have been erected all over the country. The majority of these masts are of wooden structure, and a number of cases have come to one's notice of such poles collapsing, due to the rotting away of the portion below the ground, with the result that damage has been done not only to the property of the owner, but to that of adjacent premises. Those who have wooden wireless masts should certainly make a point of examining them around the base, to detect signs of rotting. Certain woods, such as Scots pine, rot fairly quickly. By digging away a few inches below the ground level, one can detect whether there is any sign of decay of the timber. The worst part of a pole as regards rotting is that a

few inches above and a few inches below the ground. It is advisable when erecting poles to heavily tar or creosote that part of the wood which goes below the ground and a few inches above the ground.

AERIAL SYSTEM IMPROVEMENTS

While the conventional aerial-earth system is considered to perform the function of a condenser—two plates with a dielectric between them—for induced currents a closed circuit is necessary unless the currents have a very high frequency. If we consider the aerial-earth system as a circuit in which currents are induced by the transmitted electro-magnetic waves, we see that one portion of the circuit is missing. The circuit is completed from the aerial to earth through the intervening atmosphere because of the high frequency of the currents, but with a loss in efficiency. If this gap in the circuit be bridged by a wire, then the circuit is complete.



Methods of improving Outdoor Aerials.

With this object in view a wire was taken from the end of the aerial opposite the lead-in and the other end of the wire was connected to a plate buried in the earth somewhere near the foot of the aerial mast (See Fig. A.)

The results gave increased signal results, but the purity of reception was marred by noises due to earth currents. Signals were again improved and the trouble due to earth noises done away with by cutting out the earth plate and lengthening the new wire from the opposite end of the aerial until it reached, and was connected to, the earth. The wire was buried a few inches below ground as shown in Fig. B. The increase in signal strength is noticeable on the medium broadcast wave-lengths, but does not seem to increase on the longer wave transmission; an increased length of aerial is probably required for the latter.

ALARM CLOCK

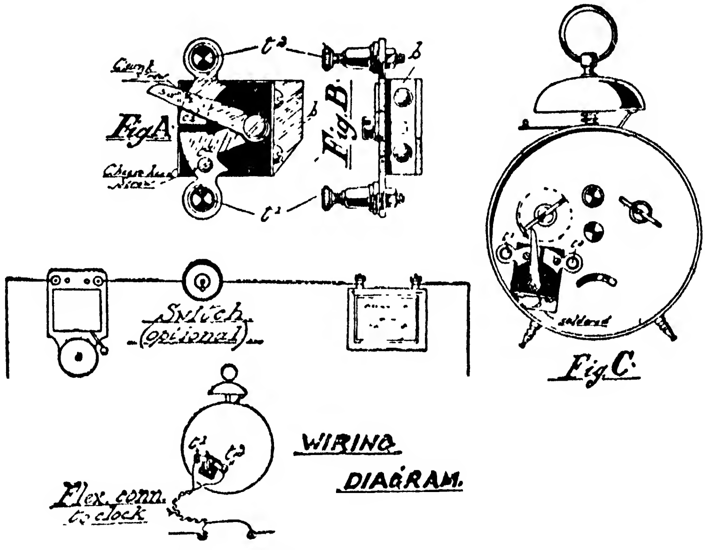
It is a well-known fact that an ordinary alarm clock may be fitted up so as to bring into action an electric bell, which then continues to ring until the supply current is switched off.

This is usually arranged by fitting contacts inside the clock, these

contacts being connected to terminals mounted on the clock case. The fitting of these contacts necessitates the removal of the works of the clock, with a consequent risk of damage to the latter.

In a method shown in the sketches herewith, it is unnecessary to remove the works from the clock; in fact, it is not even necessary to remove the back of the clock case.

Construction.—The sketches should make the principle quite clear. A small one-way switch, consisting of two contacts, C^1 and C^2, with terminals, and an arm *sd* of thin strip brass mounted on a block of ebonite, about 1 in. square and $\frac{3}{8}$ in. thick, is fixed to the back of the clock case by means of a small angle bracket made from strip brass about $\frac{1}{16}$ in. thick. The angle bracket is first soldered to the back of the case and then the ebonite block is fixed to it by means of two small screws, as shown. A minimum amount of flux should be used for soldering or the excess of flux may find its way into the interior of the clock. For this reason, also, an acid flux should not be used.



Details of Simple Type of Electric Alarm Clock.

The action is quite simple. The alarm movement of the clock is wound up in the usual way, and the switch arm *sd* moved to the left, or "off" position. When the alarm rings, the key commences to unwind and as it does so it catches against the end of the switch arm and moves it over to the right, so switching on the current to the electric bell. This will continue to ring until the switch arm is moved back to the "off" position.

Position of Switch.—The best position for the switch must be found by experiment. Fig. C shows how the switch should be fixed adjacent to the key which winds up the alarm movement. It should be noted which way this key unwinds, as, if it unwinds in the opposite direction to that shown, it will be necessary to reverse the positions of the contacts C^1 and C^2, and the switch arm also will have to be reversed. The switch arm *sd* should move rather freely or the resistance it offers to the key will cause the latter to unscrew and drop off without actuating the switch. If the key is made in two parts, with a loose "head," the latter should be soldered

to the screwed portion, the key being removed from the clock for this purpose.

In the sketches the contact C^2 is shown fixed to the ebonite block with a small cheese-headed screw. The head of this screw then acts as a stop and prevents the switch arm from being moved too far to the left.

It is hoped that the above description may be of interest to the reader who usually turns a deaf ear to the clock alone.

CABLE, JOINING

It is often necessary when making alterations in house electric wiring to join cables together. This operation is not difficult, but must be done properly to ensure satisfactory results and freedom from fusing risks.

In the case of a three-stranded cable proceed as under:

Strip back the braiding and tapes from the ends of the wires, and spread out the strands (after making sure that the tinned surfaces are quite clean) as shown in the accompanying sketch (Fig. A). The two separate cables are then "dovetailed," as it were, one into the other and the ends twisted over as indicated in Fig. B. Care must be exercised to keep the joint compact and tight, and "kinking" of the conductor on either side of the joint must be guarded against.

Soldering the Joint.—The joint is now ready for soldering, and most wiremen use for this purpose a small spirit blow-lamp, but an iron is just as satisfactory if means for heating it are at hand. The operation of soldering should be carried out as expeditiously as possible to avoid over-heating the wire. Resin is to be recommended as a flux, but Fluxite is permissible provided it is used sparingly, and the joint afterwards wiped perfectly clean. The soldering successfully completed, it remains to tap the joint up.

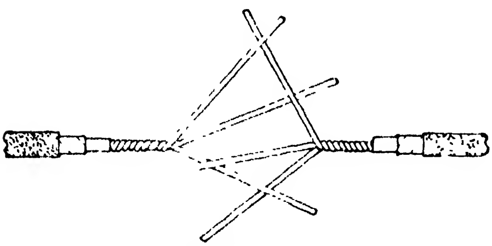


Fig. A. - Jointing Electric Cables.

Fig. B.—The Finished Joint before Taping.

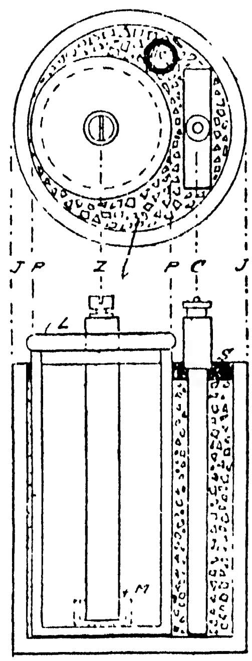
This is again a matter which calls for care. Firstly, several layers of para rubber strip must be wound over the joint, very tightly and evenly. This strip, it should be remembered, forms the insulation and it should therefore be of a sufficient thickness. Finally, to keep the rubber strip in place, and to form an overall protection for the joint, wind on a layer or two of black adhesive tape. The thickness of the joint when completed should be very little in excess of the cable itself.

The jointing of a seven-stranded cable is carried out on similar lines. The centre, odd strand is snipped out and the remaining six strands are spread out in three pairs, "married" and soldered in the manner described above.

CELLS, PRIMARY TYPE

The sketch herewith shows the most generally useful and adaptable form of cell as permitting the alternative use of several optional electrolytes to the best advantage. It is fairly portable when charged, and is convenient to pack for carriage, when it is emptied and rinsed clear of acid; its electrolytes can be bottled for use as required.

J is a vitrified stoneware jar 3 in. high by 2½ in. in diameter. P is a porous pot 3 in. high by 1½ in. in diameter. C is a carbon-capped carbon plate as used in the smallest standard-size Leclanché cell; it measures about 1¼ in. wide and must be cut to an overall length of 2¾ in. to 3½ in. Before assembling, the top of the porous pot must be thoroughly wax-saturated to a depth of ¾ in., the head of the carbon plate being similarly treated to render both impervious to liquid and to salt incrustation. The zinc rod Z is one-half of a standard Leclanché zinc of largest (No. 1) size; one end is drilled and tapped to receive a brass screw and washer, serving as a terminal; the rod is cemented into a central hole in the waxed wooden cover, or lid L. In dotted outline, at the bottom of the zinc is seen a small gutta-percha, or fibre, cup to contain a reserve of mercury M. (Although not essential, this cup-fitting is desirable for use with strong electrolytes, such as sulphuric acid in dilution with water in the (volume) proportion of 1 to 10; which is the *maximum concentration permissible.*) The cup can be cemented to the rod end (before the latter is amalgamated) with marine glue. To assemble, set the pot to one side of the jar; or, rather, eccentrically within it, with the carbon plate opposite, as seen in the plan; both the pot and the carbon may with advantage be "tacked" to the jar bottom (previously warmed) with a little marine glue.



An Economical Type of Primary Cell to make.

The whole interior space around the pot and carbon is then packed closely with granulated carbon, screened to about the size of haricot beans, smaller fragments and all trace of dust being carefully sifted out. The granular packing should be consolidated firmly by shaking and gently bumping the container, until both pot and carbon are tightly jammed in position. The grains are levelled ¼ in. below the jar's brim, covered with a layer of waxed paper and sealed with pitch or marine glue (shown black in the section at S), smoothed down with a hot iron. Before sealing, a filler tube (F in the plan) must be placed in position as shown. The neck of a medicine bottle is suitable. The sealing being thoroughly effectuated and cooled off, the paper beneath the filler F is broken away and the cell is filled and emptied repeatedly with cold water to remove

the last traces of dust. The zinc rod being amalgamated, the cell is ready for use.

Optional Electrolytes.—Its maximum output is obtained when charged with:

(a) *Bunsen electrolytes*, namely: in the zinc compartment, sulphuric acid 1 volume, water 10 volumes; in the carbon compartment, nitric acid (commercial quality undiluted). Approximate output, two hours at 2·0 amperes; or four hours at 1 ampere. Tension 1·90 volt. (Unwholesome fumes are given off while working.)

(b) *Chromic acid electrolyte*; zinc compartment as above. With the carbon, chromic acid 6 parts, water 20 parts, sulphuric acid 2 parts; all by *weight*. Alternatively (b2) bichromate of potash (saturated solution) 5 volumes, sulphuric acid 1 volume. Output (approximately), 1 ampere for two hours at 2·0 volts; or 0·50 ampere for four hours. (Fumes negligible if zinc is thoroughly amalgamated.)

(c) A variant of (b2), muriatic acid instead of sulphuric acid with bichromate solution in the carbon compartment. In the zinc compartment, zinc chloride in solution 1 to 5; or (alternatively) ammonium chloride in half-saturated solution. Output in amperes as (b), at about 1·90 volt.

(d) *Sodium nitrate electrolyte*; zinc compartment as (b); carbon compartment, nitrate of soda in saturated solution 1 volume, sulphuric acid 1 volume. Approximate output as (b), voltage about 1·95.

Dilution of any of the above electrolytes adapts the cell for lesser outputs (in milliamperes) without appreciable alteration of volt tensions while proportionately reducing the consumption of metallic zinc.

(See also article on Leclanché cells.)

CLOCK

The following is a description of an electric clock which can be made by any handyman without any electrical or clock-making experience and it will be noticed that the material can generally be found in any amateur mechanic's scrap box.

The battery is one large Leclanché cell, the consumption being very small. There are two separate cells exactly alike so as to change over from one to the other at intervals, although this is not altogether necessary.

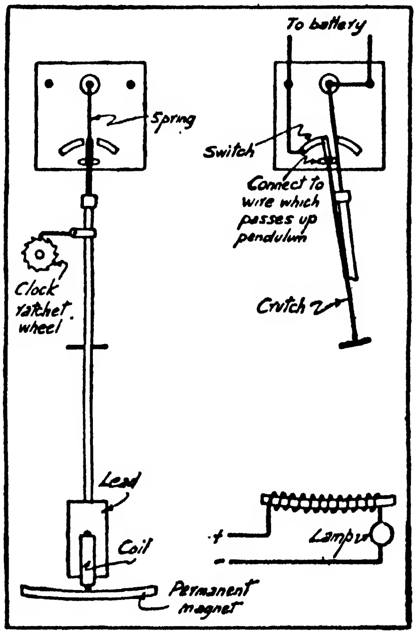
The clock consists of a pendulum suspended in the usual manner by a piece of a small clock-spring. On the end of the pendulum is a lead weight There is no fixed rule for the weight, about 1 or 2 lb. being satisfactory Below the weight is fixed a coil. This coil is made from an old telephon induction coil by unwinding the secondary, then the primary wire, and rewinding on the secondary (that is the fine wire), afterwards filling up the remainder of the bobbin with No. 30 s.w.g. d.c.c. wire. One end of the coil is soldered to the pendulum, the other is taken to a small switc which is operated by a crutch from the pendulum. The switch is easil understood from the sketch.

An old clock is obtained, and the balance wheel, lever, and mainspring removed.

This is driven by a hook pivoted to the pendulum rod and at every alternate swing of the latter propels the escapement ratchet wheel one tooth forward.

The length of the pendulum has to be regulated to suit the clock used.

The permanent magnet is an old flat file, made red-hot, then bent into shape to suit the arc of vibration of the pendulum bob. It is then reheated and plunged into cold water to harden again. To magnetise it, it is wound with some No. 26 s.w.g. wire (any wire of small gauge would do) and a current passed through the coil for a few hours (as sketch), thus obtaining a north and south pole, the wire afterwards being removed. A small bracket can be fixed to the magnet by drilling and riveting before rehardening the file.



Illustrating the Principle of Electric Clock.

The action of the clock is as follows:

As the pendulum swings to, say, the right, it pulls the crutch level with it and so switches on the coil, which is connected in such a manner as to produce a north or south pole to face the permanent magnet. If, say, it is a north pole that is facing the coil, then a north pole must be produced; if not, reverse the battery, as like poles repel each other. The pendulum bob is pushed away (the current is still on the coil), and as the bob swings over the other end of the magnet it meets a south pole and, as unlike poles attract, it receives a pull. On reaching the end of its swing it catches the crutch level and pulls the switch off. Now it swings back by its own weight until it again pulls the switch on by means of the crutch. The crutch can be set by connecting an electric bell across the wires to the coil. The bell will ring during the one swing and be silent during the other.

DOMESTIC ELECTRIC WORK

Systems of Supply.—Electrical energy is supplied to a consumer either as Direct Current or as Alternating Current. The latter is the more usual. Large consumers are given a supply at high voltage, but that is neither desirable nor necessary for domestic purposes, where 200 to 250 volts is common. The supply will reach the consumer through two wires either separate or arranged as a cable. One of these wires will

be earthed by the generating station. The earthed wire is not necessarily the negative one.

Fig. A shows two D.C. generators each giving 200 volts output and coupled together so that the total voltage is 400. If three wires are then taken from the combined machines there will be two separate 200 volt circuits and one of 400 volts. This arrangement is very convenient for the generating station because the high voltage can supply medium to large power requirements, losses in the cable are reduced, less copper is required and the current in the cable is lower. The circuit must be earthed, and the best place to do this is at the junction of the two

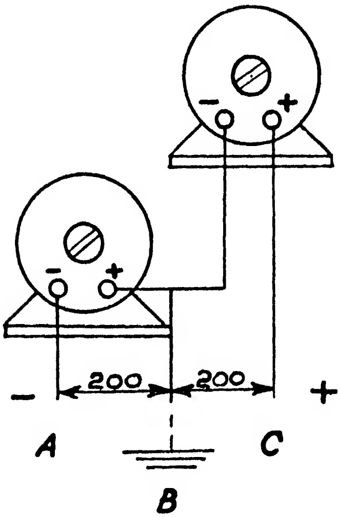


Fig. A.—D.C. Three-wire Distribution.

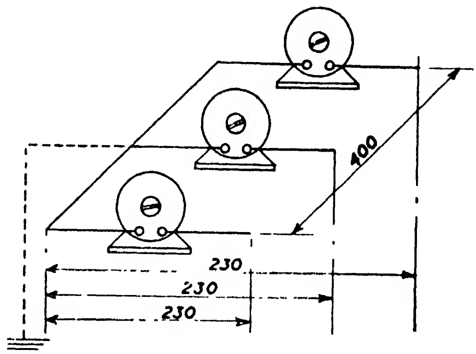


Fig. B.—A.C. Single and Three-phase Distribution.

generators. The middle wire will thus be at earth potential, the left-hand one 200 volts negative with respect to earth and the right-hand one 200 volts positive with respect to earth. Consumers connected between A and B will therefore have a "positive earth."

When the supply is A.C. the matter is a little more complicated. The usual practice then is to use in effect three generators coupled as in Fig. B, each machine giving an output of the form shown in Fig. CA. The combined output of the three is as Fig. CB and is known as three-phase A.C. It can be supplied through as few as three wires, because one terminal of each generator is common. This common or star point can be earthed. There are then three separate 230 volt supplies available. If a fourth wire be added, shown dotted in Fig. B, there is a choice between three separate 230 volt supplies and one of 400 volts. The 230 volt supplies will be of the form of Fig. CA (single phase) and the 400 volt supply will be three phase, Fig. CB.

In all these methods of distribution one wire of the supply is solidly earthed, so there is no appreciable potential between that wire and the general mass of surrounding objects. This fact must be borne in mind

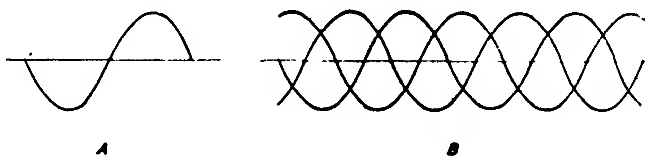


Fig. C -- Single-phase (A) and Three-phase (B) Voltages.

when planning any wiring connected to the mains, as it is one of the essential requirements for a safe and shockproof system.

Domestic Supplies.—The electrical energy, whether D.C. or A.C., will not exceed 250 volts for domestic use, and if A.C. will almost certainly be single phase. Lighting and power are supplied through the same cable in most cases, the only difference being that as power charges are different from those for lighting, separate meters will be installed. Fittings and fuses will be larger on the power circuits because the currents are heavier.

After the cable enters the building it passes through a company's switch. This is sealed. Following the switch, the cable goes through a company's fuse to the meters. The wires from the meters pass through additional fuses, often with a switch incorporated. These fuses are of smaller capacity than the previous ones and they therefore blow more easily. Their object is to protect the consumer or his apparatus; the company's fuses protect the mains. The switch preceding the meter is of the double pole type. That on the consumer's side of the meters must also be double pole so that when it is open the entire wiring is completely disconnected from the mains.

Methods of Wiring.—From there onward the wires are run to various parts of the house in a variety of ways. The method of carrying out the installation depends on whether the work is "new" or "old." New work is that which is installed at the time of building; old work is done on existing buildings. Generally new work is buried, and except for the switches and outlets is entirely covered by the plaster. Old work is often run on the surface. New work may be on the surface also in cellars, factories, or where frequent alterations are likely to be made.

The wire used may be stranded, and covered with cotton, rubber or lead sheathing. Cotton-covered wire needs protection from mechanical damage and it must be kept dry as well. The best way to do this is to run the wire in metal tube or conduit. This tube may be solid, in which case all the joints are screwed; or it may be open joint—fittings are then clamped to the tube.

The conduit system is excellent. When properly installed the entir wiring is cased in steel tube. This provides very good mechanical pro tection. All the tube is in electrical contact and must be earthed. Ther is therefore no possibility of shock. Fire risks are also small, while if cable develops a fault the current leakage is through the conduit to eart and not to surrounding objects.

For surface wiring lead-covered or rubber-covered wire is much used This type of cable is more easily damaged than is conduit, but as it i generally exposed th chance that nails wi be driven into it b accident is remote Installation is easy a no special tools ar needed, and if lead covered wire is use the whole outer casin can be earthed lik conduit. Rubbe covered cable has tw or three wires eac separately insulate with rubber. Th whole is then covere with a layer of toug rubber. Wire of th kind is commonl known as cab tyr C.T.S. (cab tyr sheathed) or T.R. (tough rubbe sheathed). It is pe fectly satisfactory i use, provided that is not exposed t direct sunlight.

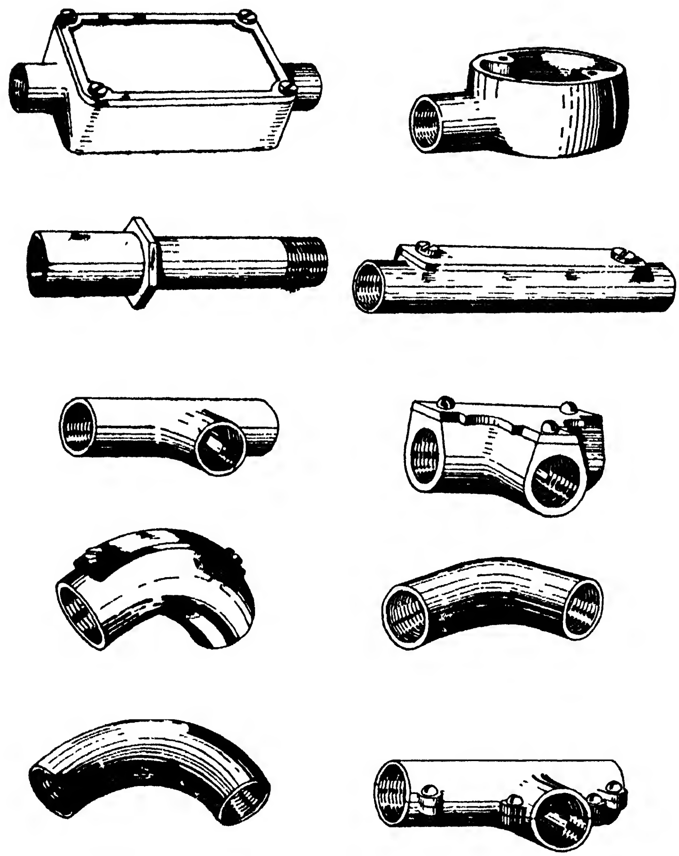


Fig. D.—A Selection of Simplex Conduit Fittings.

Wiring Systems.—For any of the methods outlined above, a complete range fittings is supplied by various makers. Conduit tube is made not on in straight lengths but in bends, elbows, tees, etc., as well. Whe outlets are to be provided iron boxes are used. These may have switch, plug or lighting fitting fastened to the front, or they may used at the junction of two or more conduits. Fig. D shows a range such fittings made by the Simplex Electric Co., Ltd. Lighting fittin and switches to work with this conduit are also made by the same fir Fig. E shows a switch plug and socket and Fig. F the type of porcela

fittings used inside the boxes shown in Fig. D. This conduit system of wiring produces an installation of the highest class. It is absolutely

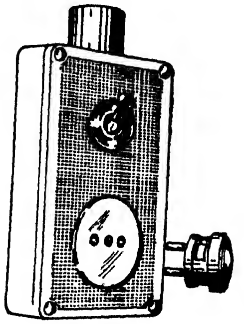


Fig. E.—Conduit-type Switch Plug and Socket.

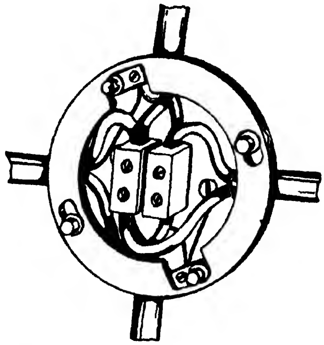


Fig. F.—Porcelain Junction-box Connectors.

shockproof and the fire risk is almost negligible. The appearance of finished work can be judged from Fig. G.

Another method of wiring uses twin rubber-covered wire with a lead alloy casing outside. This system makes an excellent installation and is

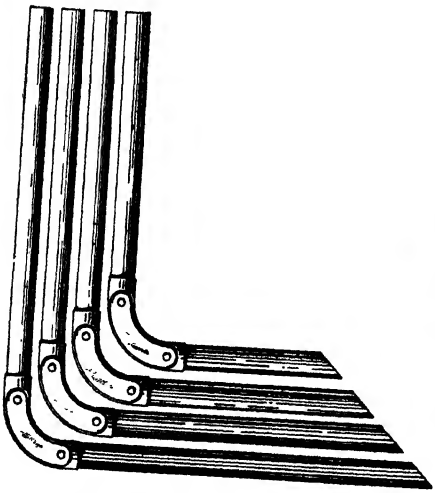


Fig. G.—An Example of Conduit Work.

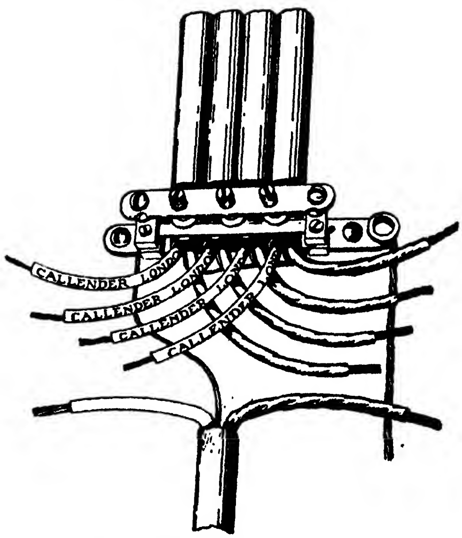


Fig. H.—Lead-covered Wiring.

quickly and easily fitted. The metal covering is sufficiently stiff to hold the wire without sagging while still being flexible enough to allow the cable to be worked round corners, mouldings, etc.

For this type of wiring different fittings are needed, and the meta covering must be earthed by other methods than those used for condui An idea of the appearance can be gained from Fig. H. The method c maintaining earth continuity varies with the type of cable, as can b seen from Fig. I. The top cable uses the lead sheathing as an earth, bu the bottom one has a separate wire for the purpose. Messrs. Callende who make these cables supply an extensive range of fittings for use wit them. That shown in Fig. J is a universal junction box in which th method of bonding the cable sheaths can be clearly seen. When com plete the box is closed by a press-on top.

If C.T.S. wiring is to be used then junction boxes and similar fitting are generally of bakelite and no provision for earthing needs to be mad A typical unit of this type, also a Callender product, is shown in Fig. K

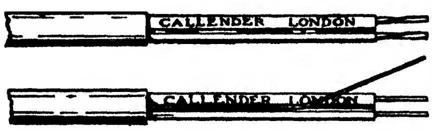


Fig. I.—Two Types of Lead-covered Cable.

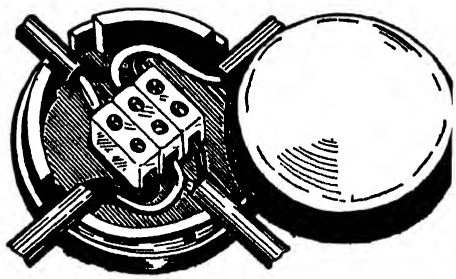


Fig. J.--Bonding by Means of a Metal Junctic Box.

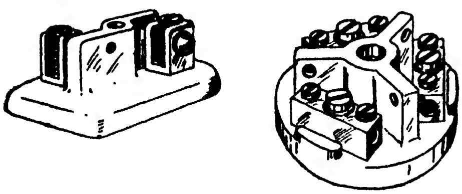


Fig. K.—Non-metallic Junction Box.

Fig. L.—Cable-fixing Buckles and Saddles.

Lead-covered cables or tough rubber ones are held in place by cli or saddles, see Fig. L, convenient for fixing to woodwork by a sing nail or screw. Saddles are usually of lead alloy and need two nails screws each. They give a rather better anchorage than the buckles a are less likely to corrode in damp situations.

When a circuit is wired with single-core cables these are sometim fastened by porcelain or bakelite cleats, Fig. M. The wires are held grooves so made that one size of cleat will grip several sizes of cab Surface wiring by means of cleats must not be used where it is possib to touch the conductors. The main use for cleats is for industrial wiri where easy inspection and frequent alteration are necessary.

Domestic Wiring.—Whatever the system used in the original wiri of a house, extensions will probably be made to it by surface work

either T.R.S. or lead-sheathed cable. The additional wiring must form a complete circuit when joined to the existing cables and, in the case of lead-sheathed cable, must be earthed to the existing conduit.

Before attempting any extension to the wiring a thorough inspection of the layout should be made. After the cable entry a main switch and fuses will be found (distinct from the service fuses) generally followed by a group of fuses arranged to protect different sections of the installation. This method has the advantage that a fault in one part of the building blows the section fuse but leaves the remaining parts still working. The diagram Fig. N will be found very useful for reference here as it shows a typical house installation. Having identified the various parts of the wiring, extensions to it can be made with reasonable confidence. As an example of the procedure, consider the fixing of an additional lighting point, say in the left-hand downstairs room and with a switch on the inner wall. The wire to the switch can be run on the surface of the wall. A wooden ceiling plate will be needed, a ceiling rose, a switch and switch block, a quantity of cable and sufficient clips to hold it, with nails or plugs and screws to secure them to the wall. Two $2\frac{1}{2}$ in. No. 8 screws will serve to fix the ceiling block, a further two for the switch block and four 1 in. No. 7 screws for fixing switch and ceiling rose to their blocks. A junction box with room for three porcelain connectors will also be needed.

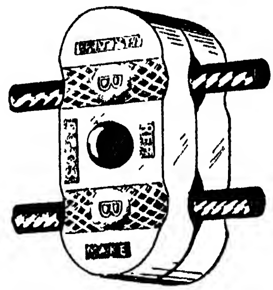
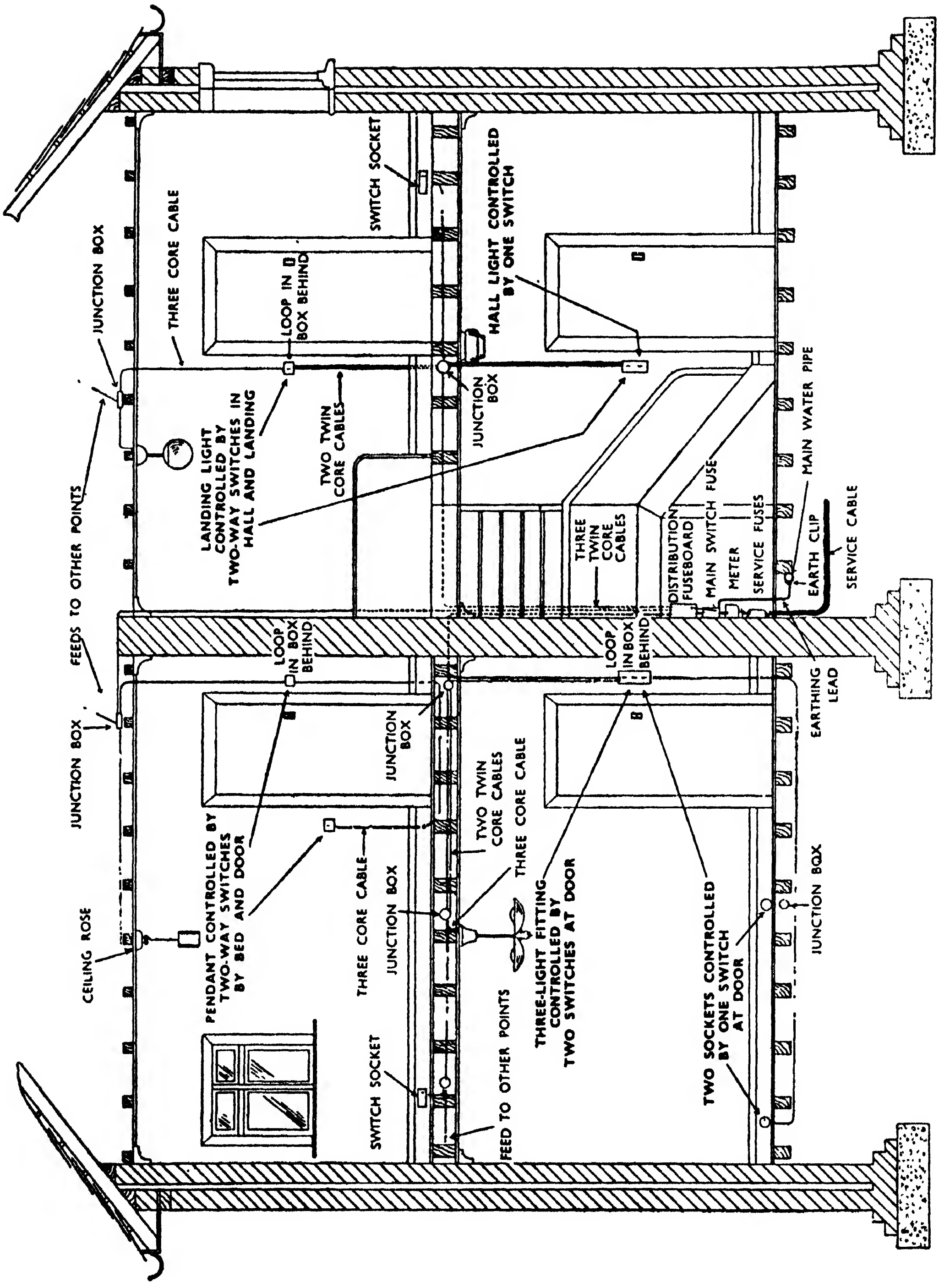


Fig. M.—Porcelain Cleats for Surface Wiring.

Decide on the position of the light and switch. The chosen place may have to be modified slightly to fit in with the house joists. To find where these are, tap the ceiling gently with a hammer. The resulting sound will vary from hollow to solid, and the latter indicates the joist. Find a place between the joists and drive a thin bradawl through the ceiling. Then remove an upstairs floorboard over the place where the bradawl is inserted. The boards may be tongued and grooved, in which case they will not lift. Mark out a length on the selected board so that it just comes between two joists. Then take the thinnest possible tool (a putty knife, or old table knife sharpened at the end) and insert it in the joint between the boards, drive it down, and repeat until the whole length on both edges of the board has been cut through. Now push a keyhole or pad saw through one of the cut edges close to the joist and saw across the board. Repeat at the other end. If preferred a small hole ($\frac{1}{4}$ in. or so in diameter) can be made in the board for the entry of the saw. When cut, the board can be prised up.

Look for the bradawl point, and if it is in a good place remove it and enlarge the hole through the ceiling to about $\frac{1}{2}$ in. diameter. Bore and countersink two holes in the ceiling plate for the screws and another two to allow the wires to come through to the lampholder. Then screw the ceiling plate in position. For a simple lamp the hold of the screws in


JUNCTION BOX
THREE CORE CABLE
FEEDS TO OTHER POINTS
LANDING LIGHT CONTROLLED BY TWO-WAY SWITCHES IN HALL AND LANDING
LOOP IN BOX BEHIND
TWO TWIN CORE CABLES
SWITCH SOCKET
JUNCTION BOX
HALL LIGHT CONTROLLED BY ONE SWITCH
THREE TWIN CORE CABLES
DISTRIBUTION FUSEBOARD
MAIN SWITCH FUSE
METER
SERVICE FUSES
EARTH CLIP
MAIN WATER PIPE
SERVICE CABLE
EARTHING LEAD
LOOP IN BOX BEHIND
JUNCTION BOX
CEILING ROSE
PENDANT CONTROLLED BY TWO-WAY SWITCHES BY BED AND DOOR
LOOP IN BOX BEHIND
JUNCTION BOX
TWO TWIN CORE CABLES
THREE CORE CABLE
THREE CORE CABLE
JUNCTION BOX
THREE-LIGHT FITTING CONTROLLED BY TWO SWITCHES AT DOOR
SWITCH SOCKET
FEED TO OTHER POINTS
TWO SOCKETS CONTROLLED BY ONE SWITCH AT DOOR
JUNCTION BOX

the laths will be sufficient, but heavy fittings will need extra support; they are then generally fixed to the joists.

Now remove another board and make a second hole through the ceiling that will just take the switch wires. Work upwards from the ceiling to avoid splitting the plaster. Drop a piece of string weighted at the end from this hole and make a series of pencil marks down the wall as a guide for fixing the switch wire. Prepare the switch block and fasten it to the wall by screws driven into wooden plugs. These plugs should go into the brickwork unless the plaster is both good and thick. Work a length of cable through the hole in the ceiling and through the back of the switch block before finally tightening this to the wall. Do the same with the ceiling rose.

Running the Wires.—The next thing is to run the wires. Before this is attempted *switch off the mains* and remove the fuses for the section involved. The whole work can be done by the experienced with the "juice" on, but that is not a practice to be attempted by the inexpert. An electrical circuit can be a simple and quite harmless thing, but equally, two small wires when touched can release as much power as a dozen motor-buses. This happens with all the devastating suddenness of an explosion, and the results can be disastrous. Therefore switch off.

The first thing is to find a junction box. Two convenient ones are shown between the ceiling joists, Fig. N. Select the one feeding the light pendant and remove the lid. The internal appearance will be something like Fig. K. Each cable will have one red and one black wire. Two cables will be found going back to the switch and another going through the wall. These last two wires are the ones from the mains. Follow them through and note where they are connected in the junction box. Place the new junction box conveniently and proceed to wire up as in the drawing, Fig. O. First run a length of cable from the red and black of the existing junction box to two of the connectors in the new box. Now take the cable from the switch and join its red wire to the red of the new box and its black to the unused third connector. The cable from the lamp is now brought to the junction box. Its red wire goes to the black third connector. The black lamp wire is then joined to the black of the second connector. The reasons for this procedure will appear later in the section on earthed conductors.

If the cables run anywhere near a gas pipe they should be bent and fixed so that they do not touch it. Clips for the switch cable can now be fixed to the wall about 12 in. apart. The sequence of closing them is shown in Fig. P. Tap the cable with a mallet so that it lies nearly against the wall, dispose of the slack of both cables between the joists, fix the lids of the junction boxes, thus earthing the lead sheathing, and refix the floorboards. Where these have been cut it will be necessary to nail a wooden batten to the joist to support the ends of the boards.

All that remains is to bare the ends of the flex between the lamp and the ceiling rose and fix the lampholder to one end. Pass the other

end through the ceiling rose and make a knot in it to take the weight of the lamp and shade. The proper way to make this knot is shown in Fig. Q. Fasten the ends of the flex to the fixed part of the ceiling rose and screw on the cap. The fuses can now be reinserted, a lamp placed in the holder and the switches closed.

Two- and Three-way Switching.—The switch used in the lamp circuit just described would be of the single-pole single-throw type of which

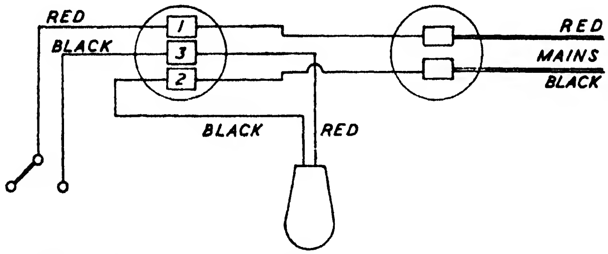


Fig. O.—Lamp Wiring in Diagram Form.

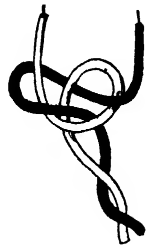


Fig. Q.—Knot for Use inside Ceiling Rose.

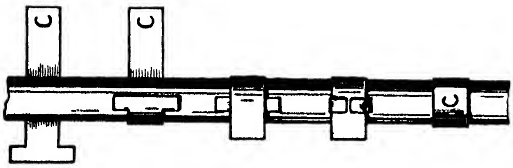


Fig. P.—How to close a Cable Buckle.

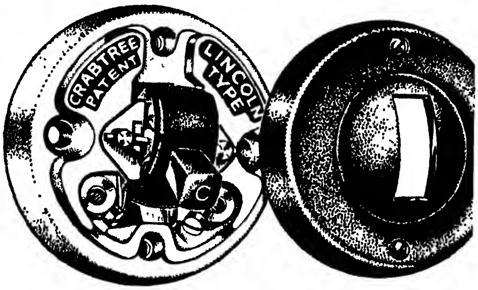


Fig. S(A).—Single-pole, Single-throw Switch.

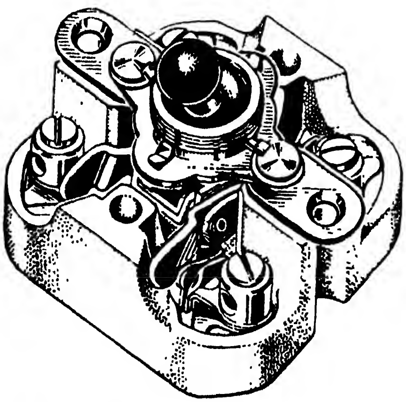


Fig. R.—Interior of a Single-pole, Double-throw Switch.

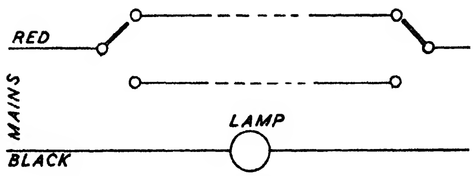


Fig. S(B).—Two-way Switching Circuit.

Fig. S(A) is a typical example. For other purposes different switches woul be needed. Suppose that it is required to control a light from two separat places such as the top and bottom of a flight of stairs. Two switche each of the type shown in Fig. R—two-way switches—must be use The circuit is given in Fig. S(B) in which it will be seen that three wires a involved. With the switches in the position shown the lamp will ligh Moving either switch down puts the light out. Following that, movin either switch either way puts the light on.

The scheme is capable of being extended so that the lamp can be controlled from three or more positions. To do this a four-contact switch, known as an intermediate, is needed. The internal construction is shown in Fig. T. It is used in the circuit of Fig. U and makes contact horizontally between 1 and 2, 3 and 4, or diagonally between 1 and 4, 2 and 3.

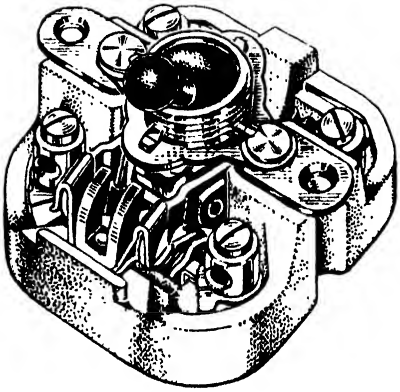


Fig. T.—The Working Parts of a Two-way Intermediate Switch.

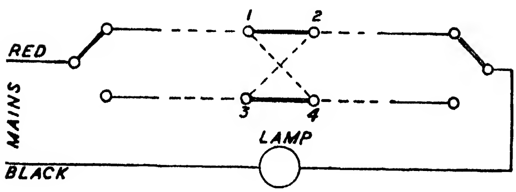


Fig. U.—Circuit for Three-point Control.

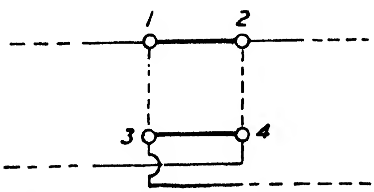


Fig. V.—Modified Form of Fig. U.

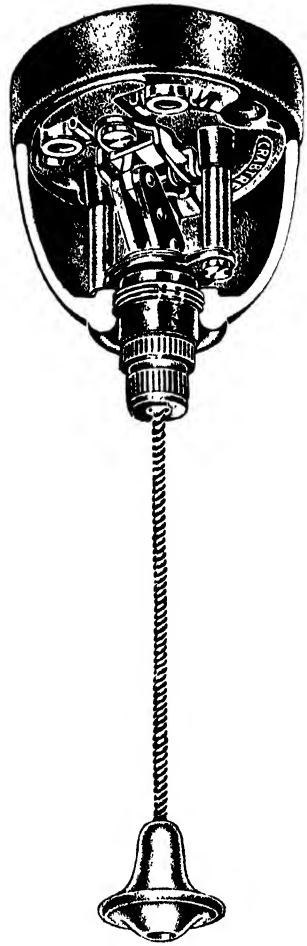


Fig. W.—A Pull-cord Switch.

Assuming the contacts to be horizontal the circuit will be seen to be identical with that of Fig. S(B). If, though, the contacts are diagonal, as shown dotted, there will be no current flow until one of the two-way switches is moved. Some manufacturers arrange their switches to make contact between 1 and 2, 3 and 4, and then between 1 and 3, 2 and 4. All that is needed then is to cross over one set of wires. Fig. V, which is a modified form of the centre part of Fig. U, shows the alteration. Either top or bottom wires can be crossed over.

Instead of the two-way switches being fixed to the wall, one or more may be secured to the ceiling and worked by a pull cord. That is convenient for bed lights. Fig. W shows this type of switch as made by Messrs. Crabtree. It has the great advantage that there is no need to run a three-conductor flex down to a pear-type switch, a clumsy and sometimes dangerous method of control.

Fitting a Power Plug.—Most of the work of fixing a power plug is the same as for the light already described. If separate wiring is installed the plug will naturally be wired to the power circuit. In no case must apparatus taking more than 1 Kw. be connected to a lighting circuit or to a power circuit through 5 amp. fittings.

Wherever possible power plugs should be of the three-pin type and the apparatus used from them should have three-core cable. The third wire is for earthing and is usually white.

Cables would be run to the power point from a junction box as already described. Red of the cable would go to the switch and black to one of the small sockets on the plug. A short black or red wire can then link the other small socket to the other side of the switch. The large socket has a separate wire run from it to a convenient water pipe to which it is securely fastened. This wire must never be fitted with a fuse. The purpose of the third wire is to make the metal part of any apparatus used from the plug safe to handle. This point, and the general question of safety, may now be considered.

Safety Precautions.—In most electrical apparatus the part carrying current is insulated. An electric fire, for instance, has the heater wire carried on a piece of porcelain, and there is no direct metallic connection between it and the frame which can therefore be handled safely. Should the insulator become defective through damage, damp or dirt, current leaks to the metal frame. If the apparatus is standing on a dry wooden floor the frame may build up to a potential equal to that of the mains. A person touching it can accordingly receive anything from a mild pricking sensation to a fatal shock.

The same apparatus can be rendered quite harmless by fastening an earth wire to the frame and to a convenient water pipe. Current that leaks to the frame is then conducted straight to earth, and the apparatus does not acquire any appreciable potential. For kitchen or bathroom use, everything possible should be earthed.

Sometimes shocks are received from apparatus that is switched off. That indicates a defect in the method of wiring. It was mentioned earlier that one main is always at, or very near, earth potential. Normally that wire will be black and there will be no switch in it. Reference to Fig. X(A) shows that when the switch is open the whole of the wiring to the left of it is connected only to the earthed main and is accordingly "dead." Fig. X(B) shows the switch wrongly placed, and the whole circuit is now at the full mains voltage. A person touching any metal part of the circuit may therefore get a shock. Switches should be wired as in

Fig. X(A) unless they are isolating switches having a contact in both leads.

In some old wiring it is by no means easy to be certain of the live lead. A good method then is to fit a lampholder with two separate leads a few feet long. Fasten one of these to something known to be earthed, e.g. water pipe, bath, kitchen range. Hold the other wire well away from the bared end and touch this on the two wires, one after the other. One wire should light the lamp and the other should not. The one that gives a light is the live main and the other the earthed one. Having found this, arrange all switches so that when off the apparatus is connected only to the earthed wire.

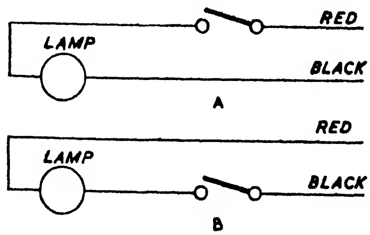


Fig. X.—(A), The Right Way.
(B), The Wrong Way.

Fitting Fuses.—Another safety precaution is the fitting of fuses. They are weak places in the circuit, deliberately arranged so that any overload will destroy them and nothing else. The working of a fuse depends on the simple fact that a piece of wire gets hot when carrying a current. The greater the current the greater the heat. In a simple circuit the current throughout is equal. Therefore if the wire is all of the same resistance and size it will all heat equally. If a piece of wire of small size or high resistance is placed in the circuit it will be carrying the same current as the larger wire and will therefore get hotter. Eventually if the current is large enough the wire will melt and thus break the circuit. By choosing a small wire the temperature rise of the rest of the circuit is thus limited to a safe amount.

Fuses should clearly be fitted where they are easily accessible and well lighted. They must also be fireproof. For this reason most fuse boxes are of porcelain. They have two fixed contacts and a movable bridge with contacts matching the fixed ones. Clamping screws are provided so that the requisite thin wire can be fixed across this bridge piece. The fuse wire can be of any metal. Steel "blows" very rapidly but is not good as it tends to corrode. Lead alloy wire was popular at one time, but the usual material now is tinned copper.

Rating.—In general a fuse should blow at about twice the normal circuit current. "Close-space-fusing," in which the wire will melt at very slight increases of current, is not recommended because surges and temporary overloads will then blow the fuse unnecessarily. Further, the exact rating depends on the length, tension, position and ventilation of the wire and so is very difficult to determine. Suitable sizes of copper wire for fuses is given in the Table on the next page.

Replacing a Fuse.—When a fuse blows the first thing is to switch off and discover the cause of the excess current. A lamp may have failed, flex may be broken, an iron may have developed a defect. Look for signs

of burning, for small beads of molten copper, or trace by the smell o scorched insulation. Having found the defect, remove the apparatu for repair. Now find the fuse that has blown. This may be near the mete or at various other places according to the layout of the building. If i doubt, remove each fuse carrier in turn until one with a broken wire i found. Loosen the clamping screws and remove the short ends of wir from them. Select a new wire of the same diameter, clamp one end unde

FUSE WIRE TABLE

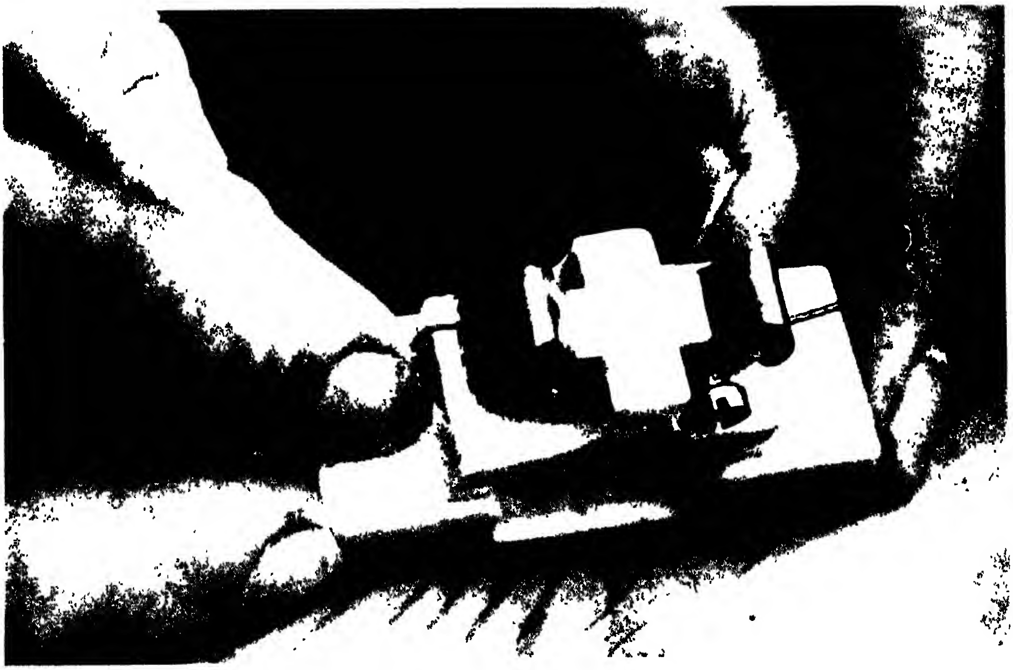
Current Rating (amps.)	Tinned Copper Wire	
	Diameter (in.)	S.W.G.
1·8	·0032	44
3·0	·0048	40
5·0	·0068	37
8·5	·0092	34
10·0	·0108	32
13·0	·0124	30
15·0	·0136	29
20·0	·0164	27

one screw and take the other end to the second screw. Do not pull th wire tight but leave a little play when the second clamp screw is tightene up. The bridge may then be replaced. When renewing a fuse remembe that at least one of the contacts will be live unless the main switches ar opened.

Repairing Domestic Fittings.—The commonest cause of the failu of domestic fittings is breaking of the connecting leads. Next in orde are failure of heater elements, switch and plug contacts, and occasionall failure of the wiring itself.

Leads break where they are subject to most bending, i.e. at or near th plug or the inlet bushing. Suppose that a table lamp refuses to ligh First substitute a bulb known to be good. If no light results try the lam on a different socket. If there is still no light the trouble is probably i the connecting lead. Run this through the fingers slowly and watch f damaged insulation or for a place where the lead bends very readil both are likely places for a break to occur. When the defect is near th end of the cable cut off the piece affected. Remove the outer covering f a distance of about 1 in. and then bare the ends of the wire for about ½ i Be careful not to damage the wire as that would soon cause anoth failure. Remove any old wire from the fitting or plug and insert th newly prepared ends. If possible double the wire where it comes und the fixing screws. Tighten these securely, replace any caps or covers, ar if it can be done put a layer of adhesive tape where it will secure th

(1) Turn off the Mains Switch. Remove the Defective Fuseholder by pulling it out. Unscrew the Holding Screws at the Ends and remove Surplus Parts of Fused Wire.



(2) Use same Gauge of Fuse Wire. Pass through Hole in Porcelain, and coil around the Terminal End Screws. Tighten up the latter. Then fix other end of Wire to other End Screw and tighten this. Finally, replace Fuseholder and switch on Current.

MENDING AN ELECTRIC LIGHT FUSE.

ends of the braiding and reinforce the cable. The lamp should now work.

In addition to cable defects, heater elements sometimes fail. Domestic irons have the heater wire wound on a mica support, and a failure can generally be seen as a black spot on the mica. The proper cure is a new element, but if that is not available a temporary cure can be made by inserting a small piece of aluminium foil between mica and wire so as to bridge the break. The pressure of clamping the parts together will be sufficient to make contact.

Domestic fires and radiators also suffer from open-circuited heaters, often at the ends. The remedy is to unwrap about 1 in. of the wire, remove the end cap, and place this wire under the end screw. Replacing the cap will then automatically make the contact. Breaks in the middle of the heater can be repaired simply by twisting the ends together tightly with a pair of pliers. Always remove the plug from the socket before attempting repairs.

Vacuum-cleaner failures are often a job for the expert, but cable troubles occur as they do with irons. Another trouble is that the brushes need renewing from time to time. Two large milled-head screws will be found on opposite sides of the motor. They are almost always made from insulating material. When they are removed a light copper spring will be found, and when this is withdrawn there should be a carbon brush at the other end. If the square part of this is less than about $\frac{1}{4}$ in. long obtain new brushes. See that they are an easy sliding fit in the holders and that the springs stand out some $\frac{1}{2}$ in. from the holder when the brush is right in. Replace the screwed caps and the motor should run. If it does not, and the cable is in order, the motor is probably defective, and that is not a job that can be undertaken without some considerable experience.

General Electrical Regulations.—The installation of electrical equipment is governed by Statute, by local by-laws and by professional regulations. The statutes apply mainly to Supply Authorities. As far as a householder is concerned the local by-laws are likely to cause little difficulty if the main requirements of the professional bodies are observed. The Regulations for the Electrical Equipment of Buildings is the standard work in this country. They are issued by the Institution of Electrical Engineers and can be obtained through most booksellers. The regulations are permissive, and it is quite open to anyone to wire apparatus in such a way that it does not conform to the rules laid down. The trouble is that the Supply authority may then refuse to sanction the use of such equipment or that insurance companies may refuse to pay for any resulting damage.

A few of the chief requirements are given below. Fuses must be placed in the live wire where only a single fuse is used. Switches must also be in the live wire. The mains may not be earthed by the user even though the wire shows no voltage to ground. A sub-circuit must not carry more

than 15 amps. This means that if two 3 Kw. fires are needed they mu: each be fed from a separate cable with separate fuses. Metal switche or appliances likely to become live, must not be placed in kitchens (bathrooms within 6 ft. of earthed metal such as water taps, baths or gı stoves. All portable apparatus, fires, irons, etc., should be fitted wi three-core cable and three-pin plugs, the third pin being earthed ar connected, through the cord, to the body of the appliance.

Many other points are dealt with in the Regulations and they are we worth study. Regulations apart, no permanent wiring should be carrie out with flex or with other than proper cable. Wiring that is hooke up, second-hand switches, improvised lamp standards, joints made b twisting wire and covering the bared ends with insulating tape, all the: should be avoided as being dangerous, untidy and unworkmanlike.

READING ELECTRIC METERS

The meter that registers the consumption is a form of electric mot geared to a counting train. The motor speed is proportional to the curre used, and therefore tl total revolutions are measure of the quantit of electrical energy th has been flowing. Tl Plate facing this pag shows the driving mecl anism of a Ferran meter. A normal met has four pointers worl ing on dials divided eac into 10 parts, Fig. A Note that the markin are alternately right ar

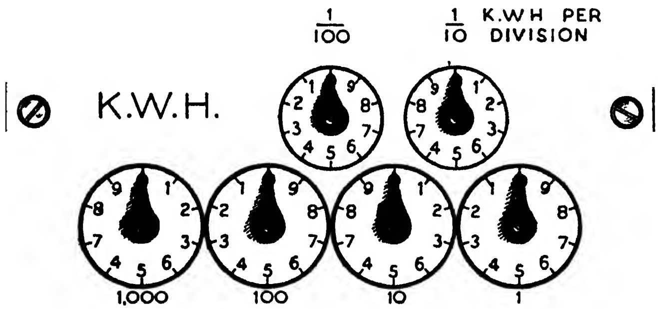
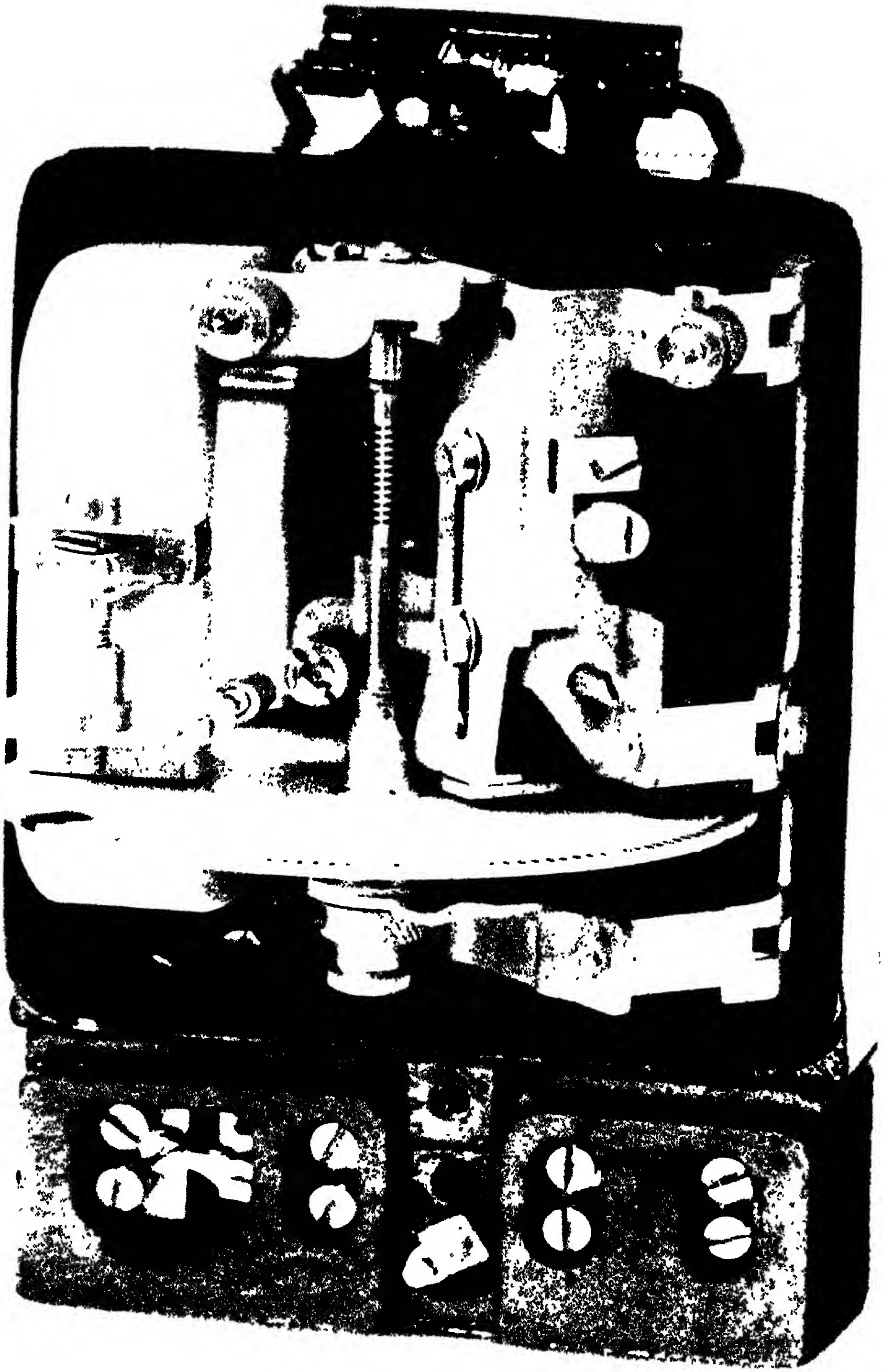


Fig. A.—Typical Meter Dial.

left handed. There is often one or more subsidiary pointers working c smaller dials. The main dials read in multiples of 10, starting from tl right-hand side. The first then reads 1 Kilowatt per division, the ne: 10 Kw., the next 100 Kw. and the fourth 1,000 Kw. per division. Tl subsidiary dials show fractions of a Kilowatt and are useful for checkir purposes.

To read the meter start with the left-hand dial and note the figure th the pointer has just passed. Repeat with the other dials, neglecting tho reading fractions of a Kilowatt. The dial shown in Fig. A is registerir zero. The consumption over a given period—say a week—is found b subtracting a previous reading from the present one. Consumption ov a short period can be read from the subsidiary dials. Those illustrate show $\frac{1}{10}$ and $\frac{1}{100}$ Kw. per division. Therefore if the $\frac{1}{100}$ dial point makes 1 revolution in 6 min. the consumption is $\frac{1}{100} \times \frac{60}{6}$ minutes $= \frac{1}{10}$ K or 100 watts per hour. Some meters are now fitted with a dial



THE DRIVING MECHANISM OF THE FERRANTI ELECTRIC METER, AS USED IN HOUSEHOLD ELECTRIC MAINS SUPPLY

which figures appear in an opening, after the manner of a cyclometer. These can be read easily and do not give rise to confusion over the different direction of movement of the pointers.

When everything has been switched off for a minute or so the indicator disk (seen below the dials) on any meter should be stationary. If it continues to move there is current leakage in the wiring. This may have a temporary cause such as very damp weather, but a permanent leakage should be traced and put right.

IMMERSION HEATERS

The fitting of an immersion heater is well within the powers of a handyman, provided that he has tools that will enable the necessary metal working to be done.

Heaters are of two main types, circulators and volume heaters. The former are generally fixed in the top of the tank and the latter at the bottom. Circulators give a limited supply of hot water quickly because they heat only a part of the contents of the tank at first. With either type the whole tank becomes hot eventually, and there is little to choose in the matter of efficiency. Both types are made with thermostat control.

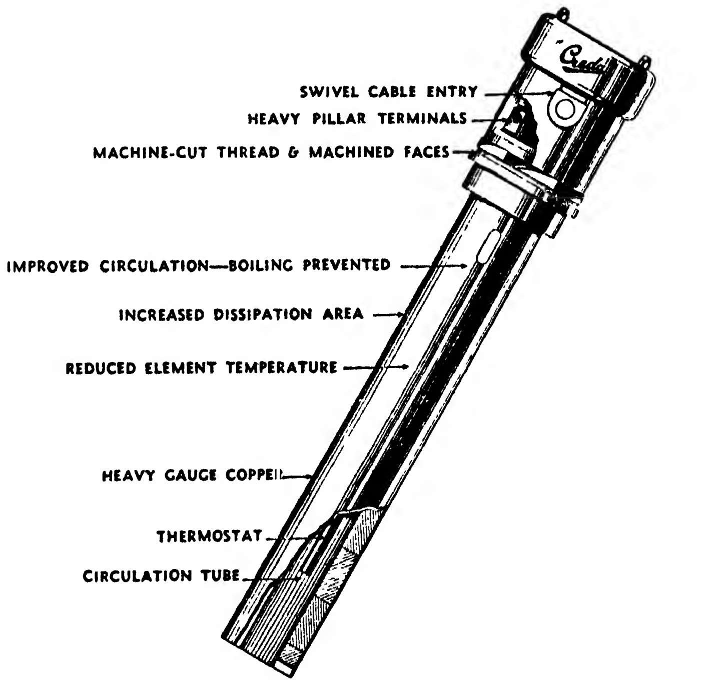


Fig. B.—A Circulator-type Immersion Heater.

The illustration Fig. B shows the general appearance of the circulator type. In effect there are two copper tubes with a heating element between the two. Water is thus heated by the outside tube as well as the inside one. The hot water rises and escapes through the vents towards the top of the tubes. It is thus possible to have a layer of quite hot water at the top of a storage tank very soon after the heater has been switched on. The longer the heater is left in circuit the deeper becomes this hot layer until eventually the whole tank becomes hot. A thermostat then comes into action and switches the heater off.

The non-circulatory heater is fitted at the bottom of a tank. Hot water is then not so quickly available, but this is of little consequence when a

continuous supply is needed. Fig. C shows a Santon heater of this kin mounted in a square tank.

Fitting an Electric Immersion Heater.—First run the wiring fro the power mains, using 5 amp. or 15 amp. fittings according to the pow of the heater. A fuse should be fitted, though this is not essential, an a lampholder should be wired acro the heater so that a neon lamp can b used to indicate when the heater is i circuit. The switch should be mounte conveniently so that the heater can b switched on without walking from or floor to another.

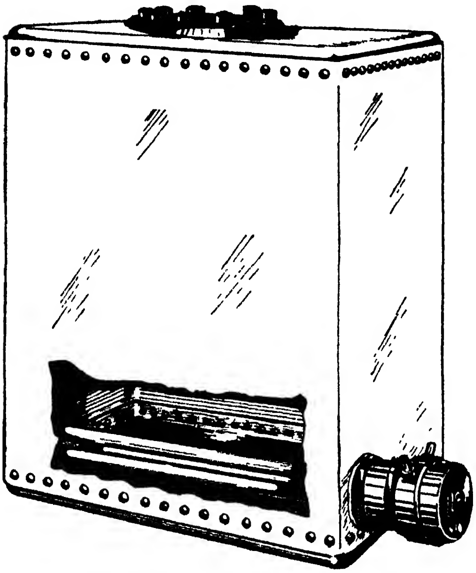


Fig. C.—Storage-type Heater fitted to Tank.

When the wiring is complete, turn th water off, drain the hot-water syste and remove the manhole cover in th hot-water tank.

Having decided on the best place fo the heater, mark out a circle on th tank with a pair of dividers and cut hole for the heater to enter. In th absence of a hole saw or trepanning too drill a series of small holes as close the line as possible; then knock o the centre and file the hole to size.

Most heaters are supplied with screwed fixing. The heater is pass through the manhole and the head pushed through the hole that has be cut in the tank. A rubber or composition washer coated with red lead then slipped over the projecting screw and the nut put on and tighten up moderately. The cables can then be threaded through the insulat outer cover and connected to the heater terminals. After this the joi may be finally tightened and the manhole cover replaced. The bolts f this latter should be run up finger tight and worked round steadily wi a spanner, giving about half a turn to each until they are all tight. An attempt to tighten one bolt and then another will almost certainly result in a leaky joint.

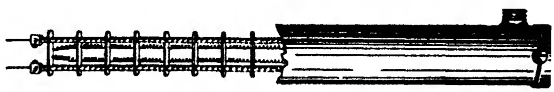


Fig. D.—Internal Arrangements of a Tubular Space Heater.

The water can now be turned on and the thermostat be adjusted, and the heater is ready for switching on. A final tighteni of the joints can be given when everything is warm, and there should be further need of attention.

A heater that has a good deal in common with the immersion type the low-temperature tubular element used at the bottom of shop windov The internal construction can be gathered from Fig. D which shows pa

of a Creda unit. These tubes are widely used for clothes airing, drying racks, heated towel rails and so on. They are easy to install and can be arranged to blend well with most domestic interiors.

FLUORESCENT LIGHTING

Tubes and fittings for this type of lighting are easily fitted. The present rather stark form in which the lights are made also offers an opportunity for the designing and making of shades.

Unlike the usual filament lamp the resistance of a fluorescent tube drops when it glows. This fall of resistance would result in excessive current unless some form of compensation was provided. A choke is the usual method of current control, and it is used in conjunction with a condenser. To start the tube, heaters at both ends must be warmed up. As soon as the tube strikes they can be disconnected. An automatic switch is provided to do this. The circuit is therefore as Fig. E. The live main goes to the condenser and to the choke. From the choke the circuit continues through the two heaters and the starting switch back to the earthed main. Because of the sparking that takes place at the automatic switch it is common practice to fit a suppressor unit. This prevents disturbance to radio receivers.

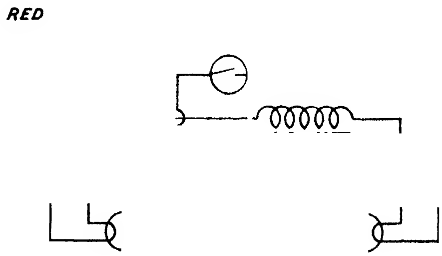


Fig. E.—The Circuit of a Fluorescent Lamp.

The gas filling of the tube does not remain alight through the whole A.C. cycle but goes out and restrikes at each period of no voltage. This tends to produce a strong flicker which causes moving objects to seem blurred, a distinct disadvantage in some situations. The best method of getting over this difficulty is to use three tubes each on a separate phase of the supply, but obviously that is possible only when three-phase A.C. is in use.

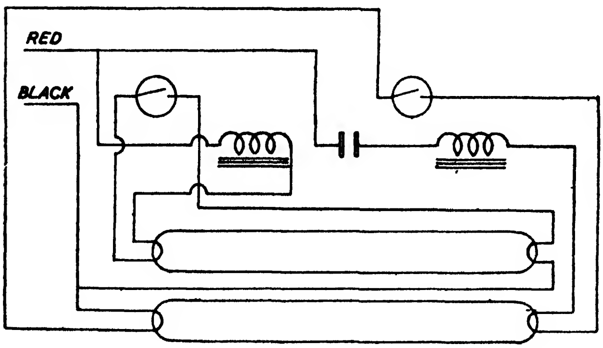


Fig. F.—Two-tube Circuit for the Reduction of Flicker.

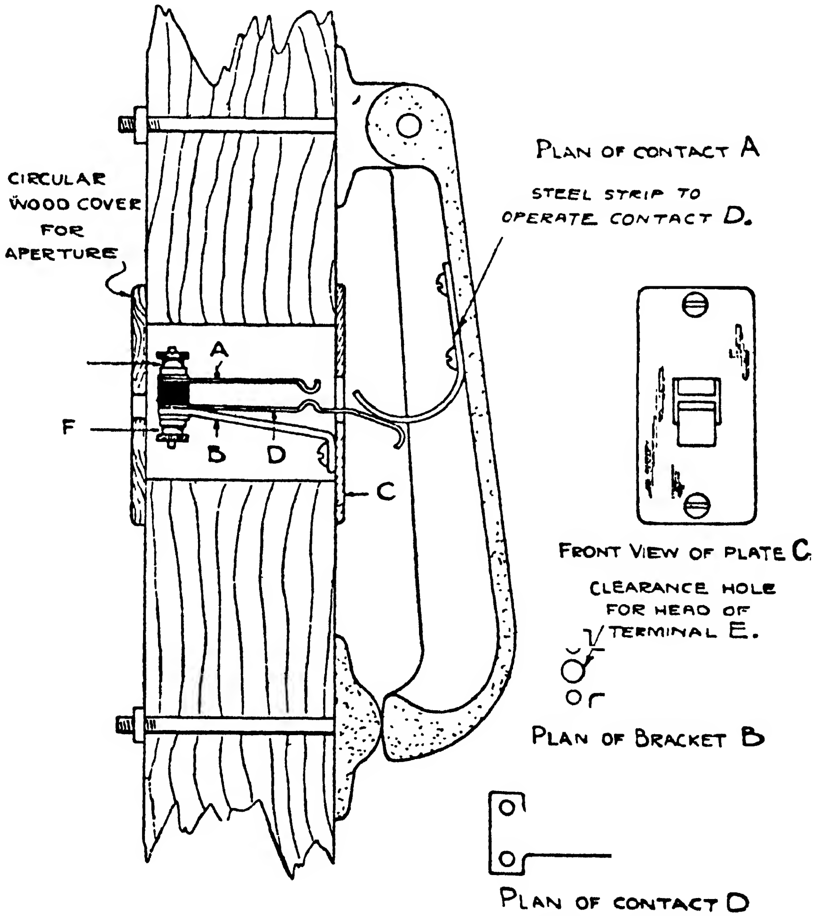
Where single-phase A.C. only is available two tubes can be used in the circuit of Fig. F. There one tube is fed through a choke and the other through a choke and condenser in series. The effect is that one tube strikes a little sooner than the other. The extinction periods are also out of step. That reduces the time when there is no light from either tube and so minimises the flicker.

A fluorescent tube should be installed where it is not subject to co draughts as they may cause erratic working. New lamps sometimes gi the effect of the column of light rotating like a screw. This usual wears off if the lamp is switched on and off a few times. A slow and pr nounced flicker shows that the lamp has run its useful life and nee renewing. Failure to light at all is generally due to a fault in the aut matic switch, but that is easily replaced.

Short tubes are now in production, and they will make possible a wid range of lighting for domestic use.

DOOR KNOCKER, ELECTRIC

When an electric door bell is required it is not always necessary to the conventional push-button switch. Most doors are fitted with t



Construction of Electric Knocker-operated Door Bell.

vertical type of knocker, and under this may be constructed a very i genious electric switch shown in the illustration. By this means an elect

bell is caused to ring in any desired part of the house when the knocker is raised. This enables the "knock" and the "ring" to occur simultaneously.

The Switch.—The switch is supported on a bracket B which is screwed to a front plate C, and consists of two contacts A and D, insulated from each other by an ebonite block. The lower contact has an extension passing through a slot in plate C and engages a steel strip that is screwed to the knocker. It is imperative to see that the shape of the contact and the steel strip is such that a clean wiping action is obtained when the knocker is raised and lowered. In the rest position the contacts are kept apart by the pressure of the steel strip, and only when the knocker is raised is the pressure removed and electrical contact made.

A circular wood cover is screwed to the inside of the door and a hole cut in it in order to lead out the two wires for the circuit which are connected to the terminal, one for each contact.

DRY BATTERY RECEIVERS

The more recent portable receivers employ a combined H.T. and L.T. dry battery, which also provides automatic grid bias. The battery is of much-improved design and lasts for several months with ordinary set use. Instead of the earlier type of wander-plug connections the modern dry battery has a 4-pin socket into which a 4-pin plug, with its leads to the receiver, plugs. Thus, the changing of a battery is a very simple matter and it is impossible to connect it to the set wrongly. The plug connections should be kept clean at all times. A note should be made of the positions and types of valves used, so that should it be necessary to remove them, they can always be replaced correctly. It is a good plan to paste particulars of valve types and locations on the back panel of the receiver, in many instances the makers provide a chart for this purpose. Most modern portable sets have their own interior aerial, but an external aerial and earth lead are usually provided, in addition, for increasing the range and volume or sensitivity. It is not necessary, however, to use an aerial exceeding 50 ft. in length. As the interior aerial type of receiver has directional properties, i.e. it gives maximum volume when the plane of the aerial points towards the transmitting station, this fact should be remembered when tuning the set.

Apart from battery renewal at certain intervals no other attention is necessary, but should the set fall off in performance after a good deal of service, it is very probable that the valves will require renewal.

Valves.—Modern valves have a useful life of at least 1,000 hours, and unless badly treated by using them with higher voltages or insufficient grid bias (in the case of L.F. valves) will last for at least two years without any appreciable drop in efficiency. If the volume of reproduction gradually falls off after some years of usage, this is no doubt due to the loss of the filament emission coating, and the valves then require replacing. The valve legs should be kept clean and open sufficiently to make good contacts with the sockets.

Locating Common Faults in Receivers.—Wireless receivers, like other electrical apparatus, are apt to go wrong at times, this tendency depending upon their design, mode of construction, and treatment.

The first thing to do is to obtain a copy of the wiring connections of your set, giving all the component details on it (values, etc.). Next you must have a continuity tester. A simple one can be constructed from the following parts:

A battery, buzzer, two-way switch, flashlamp bulb and holder, eight terminals, and about a yard of twin flex with wander plugs fitted to one end. The whole can be mounted on a small piece of wood or ebonite and wired up, as shown in Fig. A. The switch in position 1 brings the buzzer in series with the battery, and is used for low-resistance tests. With the switch in position, 2, the headphones are brought into the circuit for high-resistance tests. The lamp is used for testing the filament circuits, and at the same time it can be used for testing $4\frac{1}{2}$ volt flashlamp batteries. This is one of the best methods of finding wiring faults, dry joints, etc.

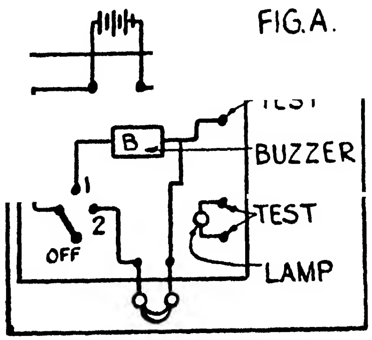


Fig. A.—Layout of Testing Device.

How to Find a Fault.—1. *External Faults.*—Before touching the inside of your set it is best to satisfy yourself that all the external connections and components are O.K. The aerial and earth connections should be examined and any intermediate switch contacts that get dirty. The conditions of H.T. and L.T. batteries must be tested with volt-meters and hydrometer, or, if eliminators are being used, they should be disconnected from the mains and tested for insulation. A low-insulation condenser will absorb most of the output of an eliminator. Grid-bias batteries must not be forgotten, as well as all terminal connections. If all these are normal and do not make any difference to the results, the fault must be in the set.

2. *Internal Faults.*—All external connections, except the loudspeaker or headphones should now be taken off the set, and the panel and baseboard taken out of the cabinet. The components should first be inspected for mechanical faults, such as loose nuts and bolts, overturned screws, and other little things which might have been overlooked when the set was first constructed. If you are satisfied with the components you may now test the wiring with the tester referred to above.

One usually tests the wiring in the following manner: filament circuit first, then the grid circuit, and finally the plate and output circuits. Each circuit should be tested with the same strictness, as they are all important and affect each other in their operations.

The following example of testing a receiver refers to the circuit shown in Fig. 2. It is a popular circuit and has been used in many sets.

(a) *The Filament Circuit.*—The buzzer test is used for this circuit. Put one of the test leads on the terminal marked I (L.T. +). The other lead is put on all wires connected to this, i.e. those marked I; the buzzer should buzz at these points. Bad contact will be denoted by no buzz or intermittent buzzing, and should be seen to at the moment. The other side of the filament may now be tried. One of the leads is now fixed on I*a*, and the other tapped at all points marked I*a*. The valve holder may be tested for continuity by placing one lead on the terminal and the other in the socket connected to that terminal; if O.K. the buzzer should operate. The connection between H.T.— and L.T. is very important, since the set will not function without it. The grid-bias positive connection is also important. This completes the filament circuits.

(b) *The Grid Circuits.*—These include the aerial-earth circuit, since it is in the first grid. With one lead on aerial terminal, Fig. B, the buzzer

FIG. B.

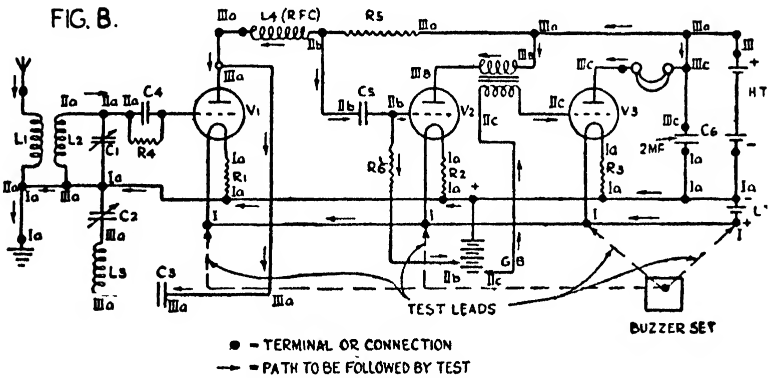


Fig. B.—Typical Circuit Diagram, for Illustration Purposes.

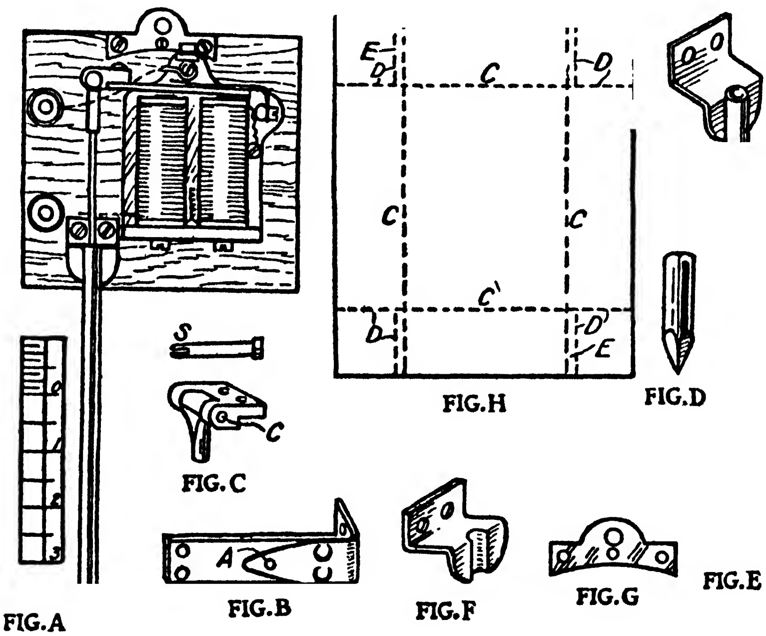
should buzz on all points marked II and to II*a*, if low-resistance, low-wave-length coils are used. If the long-wave switch is in use, the headphones on the tester should be switched in and used. A loud click denotes continuity. All the coils are tested in this manner, i.e. across each end of the coil. The grid leak should be taken out and tested separately between the end contacts. If no sound is heard, the leak is disconnected internally, and should be renewed. R_6 and II*c* (from grid terminal to G.B.—) may also be tested with the headphones. With the leads across the first grid condenser and the leak out, no sound should be heard. All the other condensers (fixed and variable) should be tried in a similar manner (C_1 with grid coil out).

(c) *The Plate and Output Circuits.*—With the headphones or loudspeaker connected in the proper position, most of the plate circuits can be tested, i.e. with one lead on III, first plate, III-III*a*-II*b*-III*a*-plate-III on C_3, other side of C_3 to coil L_3 and through this to C_2 and back to earth. Second plate, III-III*b*-III*b*-plate (primary of transformer). Third plate, III-III*c*-III*c*-plate (output circuit, headphone, etc.).

Conclusion.—The tests being completed and any fault rectified, the set may now be returned to its cabinet and L.T. battery connected up. The two test leads on the set are connected to the lamp terminals, and the plugs put in the filament sockets of any valve holder : it should light up, the brightness depending on the battery voltage; this is a final test for the filament circuits. The valve filaments may be tested for continuity by buzzing through them.

ENGRAVING MACHINE

The electric engraving machine shown by Fig. A is so easily constructed that the merest tyro with tools need have no hesitation in trying to make



Constructional Details of Electric Engraving Machine.

Fig. A.—Machine Complete.
Fig. B.—Armature and Spring.
Fig. C.—Hinge Fitting and Pin.
Fig. D.—Engraving Needle showing Shape of Point.
Fig. E.—Bracket and Needle Tube.
Fig. F.—Bracket for Tube.
Fig. G.—Attachment for suspending Machine.
Fig. H.—Cover marked out for Cutting.

one of these interesting instruments. No screwing or turning is required, just plain drilling, filing, and simple soldering being all that is necessary. The most important part is a portion of an electric bell; this is the framework and coils, in this case part of an enclosed bell. The gong and gong pillar are taken off, not being required; the armature is also removed, and the hammer shank and spring unscrewed, the last-named being too weak for the purpose required.

Construction.—The first job is to make a stronger spring. This can be of hard hammered brass or strip steel. Soften a piece of strip steel by allowing it to get red-hot and gradually cool. It will be found soft enough to take slow bends without snapping, and at the same time be sufficiently springy for the required purpose. The spring is now bent to the same shape as the spring taken off, and riveted to the armature. To do this, countersink the screwed holes in the armature on the bobbin side, place the new spring in the exact position on the armature, and mark off the holes. Drill these and then rivet the spring on with soft brass plugs; on the countersunk side file the rivets flush.

Now attach the armature to the frame, and where the point of the contact screw touches the spring solder a small disk of silver A (Fig. B). This answers very well in place of the more expensive platinum. At the opposite end of the armature drill two holes as shown in Fig. B, and countersink these also on the bobbin side. Through these the fitting to hold the engraving needle is attached. This fitting is filed from a piece of scrap brass to the shape shown in Fig. C. The hole C can be drilled to fit a suitable-size nail, as being the easiest way of fitting a pin. This should be nicked as shown at S, so that when in position it can be opened out to prevent it working loose. The swinging part of the joint is filed a working fit without play between the jaws of the upper part, and a hole drilled to take the stout steel knitting-needle with which the engraving is executed. The end that goes in the hole is slightly jagged with a chisel and then soldered in. The point is then hardened so that it will not easily blunt. This is done by getting the extreme point red-hot and quenching in water; it is now ground to the shape shown by Fig. D.

The movement should now be tried with two *sac* Leclanché cells, and the effect noticed. If the armature is not attracted when fully away from the electro-magnets, the spring must be filed thinner between the spring brackets and the armature, until the armature goes to with a snap when the machine is held in the working position.

The tube and bracket (Fig. E) next claim attention. The tube is of ¼ in. outside diameter copper, and is soldered to a bracket (Fig. F). As shown, the part of the bracket on which the tube is secured is filed to the shape of the tube until the needle will occupy the centre of the tube when the bracket is attached to the base. The bottom end of the tube has a piece of brass rod soldered in, with a fine hole drilled in the centre to take the needle a sliding fit.

To suspend the machine a piece of sheet brass is shaped out as shown by Fig. G. This is screwed to the top part of the base, a spring or a stout piece of elastic rubber being attached to it to allow the point of the needle to be pulled down to the work to be engraved.

The Cover.—The cover can be cut from sheet tin. It should be marked out as in Fig. H, the depth being represented by the outside of the lines C. The corners are cut away along the dotted lines D, leaving a piece E at each corner. These must be turned up first to form a seam

at each corner. The sides are then turned up with the covering pieces inside. Solder the joint at each corner, and fit the cover on the base. Where the hanging piece projects file a slot in the cover to pass over. It is secured to the base by means of two screws at each side. Cut a piece out to allow the cover to pass over the tube, and the machine is complete, the wiring not needing to be disturbed.

The Stand.—A stand can be easily fashioned out of wood or metal. It should be adjustable for height, an allowance of 16 in. at least being made for the length of the machine. The spring or rubber is 4 in. long.

In use, three cells will be required, a few experiments being made to get the best effect. Adjust the stand until the point of the needle hangs ½ in. above the work, and grip the tube close to the point. Having previously switched on the current, pull the needle down against the tension of the spring. Unless the operator is a fair writer, and has a steady hand, it is advisable to first write the inscription faintly with a blacklead pencil.

It will be noticed that no measurements are given in the detail drawings, as they would not apply to most bells owing to the different types in use. The method, however, will be adaptable to practically any bell with little alterations.

FIRE ALARMS, AUTOMATIC

The fire alarm illustrated at Fig. A is an electric bell circuit, which, in the ordinary way, might be provided with three or more push-buttons at various points, the junctions A and B representing the leads to other buttons, switches, or other circuit-closing devices, which, of course, are all connected in parallel. In place of the usual buttons we have a number of automatic switches, each consisting of a pair of springy brass clips normally separated by a small piece of paraffin wax which when heated melts and allows the clips to come together in order to close the circuit and actuate the alarm bell. The clips are mounted on small blocks of hard wood or fibre, which are attached to the walls and roof of the building, the wiring being effected by means of ordinary bell wire, or with soft galvanised iron wire (of a comparatively large gauge), which is stapled neatly to the walls. The battery consists of two large dry cells connected in series.

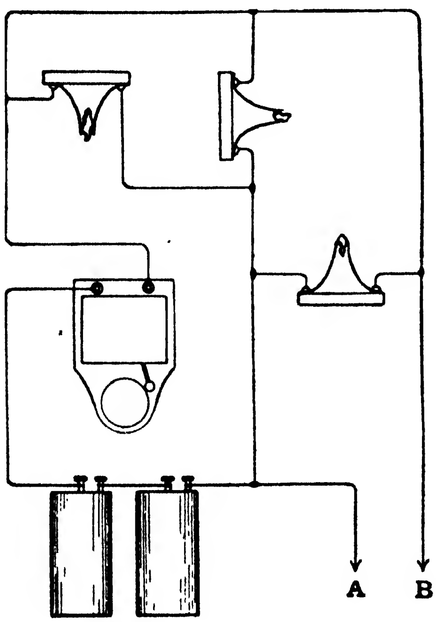


Fig. A.—Diagram of Connections for Installation employing Wax-released Contacts.

A Mercury Alarm.—The arrangement shown in Fig. B consists of a small brass tube, which is internally threaded

at one end and attached to the projecting end of a horizontal brass strip, a small leather washer being placed between the tube and the strip in order to make the tube watertight. The other end of the strip is screwed to the lower end of a hard-wood pillar, which provides a means of attaching the device to the wall in the position shown. The tube is three-parts filled with mercury. At a point near the top of the wooden pillar is secured a length of heavily insulated, single, tinned copper wire, the outer end being bared and scraped quite clean, bent to right angles, and inserted in the top of the tube, leaving a space of about $\frac{1}{8}$ in. between the top of the mercury column and the end of the bared wire. The insulation on the

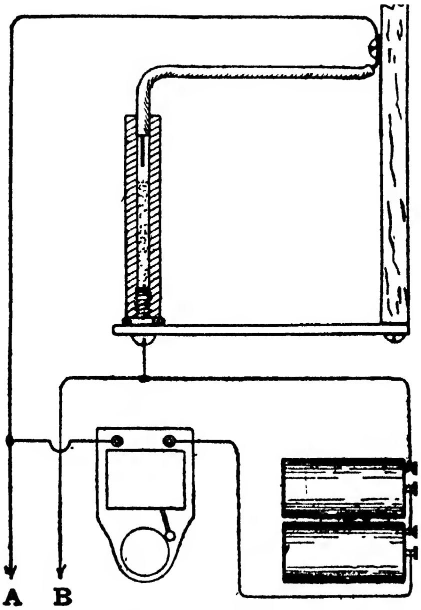


Fig. B.—System utilising Expanding Properties of Mercury.

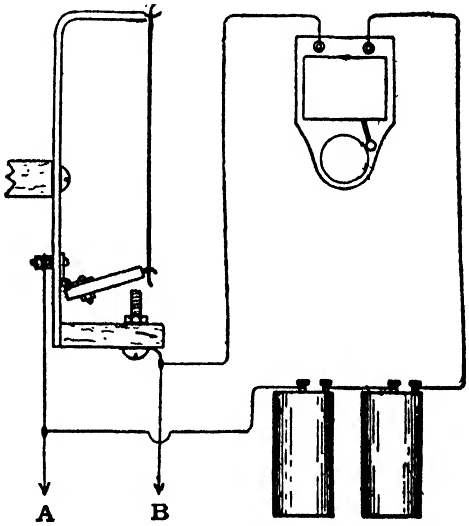


Fig. C.—The Celluloid and Gravity Contact System.

wire (preferably rubber) should fit tightly into the tube, and, if necessary, an adjustable support should be fitted between the brass strip and the wire, at a point near the tube. Connections are made preferably direct to the tube and to the other end of the insulated wire. It will be seen that by the application of a little heat the mercury expands and rises in the tube in the usual manner, thus making contact with the wire and closing the circuit.

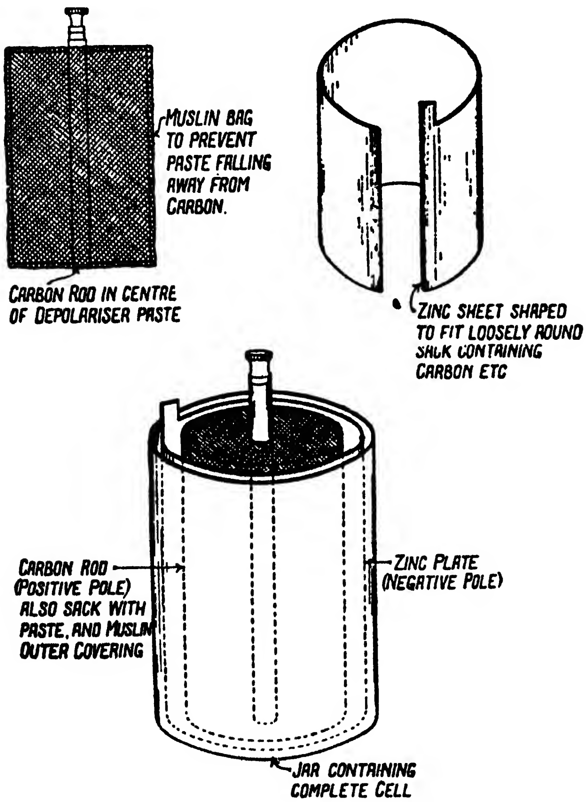
Inflammable Strip Device.—The successful operation of the device shown in Fig. C depends upon the action of a direct bare flame, one switch contact (a hinged brass bar) being normally suspended directly above the other (an inverted brass screw) by means of a long and very narrow strip of sheet celluloid or other highly inflammable material.

The action of the device should be obvious; the celluloid strip, when ruptured by the flame, releases the brass bar, which then falls upon the

projecting screw shank and thus closes the circuit. The bar is hinged to a brass angle-piece, the hard-wood block carrying the screw being attached to the lower end of same in the manner indicated in the sketch. A horizontal supporting member holds the device clear of the wall.

LAMP CAPS, TO REFIX

Electric light bulbs frequently come to grief from no other cause than the cap having come loose, the wires inside it breaking or causing a short circuit very soon after, all of which could be avoided if the cap could be conveniently refixed at once. This can be done by pushing ordinary seccotine into the space between the loose cap and the bulb, pressing the cap down on to the bulb (tie it down with string if it will not stay down), and baking in the oven till the seccotine shows signs of beginning to char; this requires a temperature of about 150° to 200° C. (300° to 400° F.), and will be found to make the cap quite secure to the bulb. Plastic wood can also be used for larger cavities.



A Home-made Leclanché Cell.

LECLANCHÉ CELLS FOR VARIOUS PURPOSES

Dry batteries after their current has been absorbed are usually discarded as useless.

These batteries can, without much trouble or expense, easily be converted into Leclanché cells for use on the domestic electric bell system, or other use which the reader has need, requiring batteries of the Leclanché type. The procedure is as follows:

Strip the outer zinc casing off the old dry battery, thus exposing a solid block, in the middle of which is the carbon rod, or positive electrode. Enclose this, just as it is, in a small sack or bag, made of muslin or similar material, leaving a little of the carbon rod (with terminal) showing. Next obtain a sheet of fairly thin gauge zinc approximately 6 in. by 10½ in. and bend it round so as to almost enclose the sack.

Place both zinc and sack in any convenient glass or earthenware jar, add

a weak solution of sal-ammoniac, and after a few minutes a current will commence flowing.

LECLANCHÉ CELLS, THEIR CARE AND MAINTENANCE

The Leclanché cell is so widely used for domestic bell batteries that it is necessary to know how to keep such cells in proper condition.

If attended to at intervals of three to six months, regularly, such cells will continue to work without trouble practically indefinitely.

The Leclanché cell has a central carbon rod or flat strip forming the positive pole, and a smaller rod of zinc which constitutes the negative pole. The central carbon is contained in a porous earthenware cylindrical pot, the space between being packed with a mixture of crushed carbon and manganese dioxide.

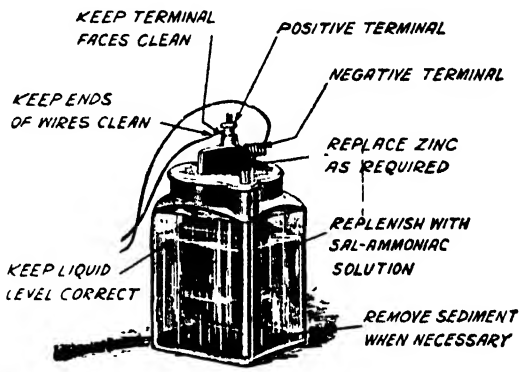


Fig. A.—Illustrating Items of Leclanché Cell Maintenance.

Into the space outside the porous pot, in the outer glass container, a solution of ammonium chloride (sal-ammoniac) is poured. The correct level is indicated by a red or black line on the glass container.

The Leclanché cell gives a voltage of about 1·5, falling slightly (1·4) after the first few hours' use.

Maintenance.—When first connecting up these cells, see that all of the terminals are quite clean, using a knife or emery cloth to eliminate any dirt or corrosion. Similarly, strip and scrape the bell-wire ends.

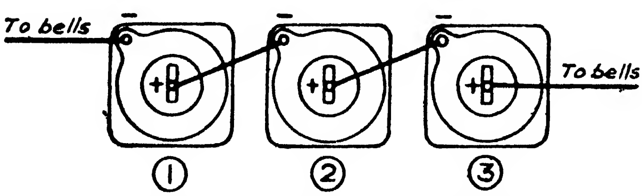


Fig. B.—Connecting Three Cells in Series to give three times the Voltage.

For the usual bell system of an eight- or ten-roomed house, two, or at the most, three cells are necessary. These cells are connected in series, as shown in Fig. B. It will be seen that the positive of the first cell is joined to the negative of No. 2, the positive of No. 2 to the negative of No. 3, and so on. Each cell adds about $1\frac{1}{2}$ volts, so that the three shown will give $4\frac{1}{2}$ volts.

After the cells have been in use for a year or so they should be examined. It will usually be found that the sal-ammoniac solution level has been lowered by evaporation, and should therefore be replenished with clean rain-water, or better, distilled water. A layer of lubricating oil on the surface will prevent evaporation.

Examine the terminal surfaces, after unscrewing these, and see that they are quite clean and bright; similarly ensure that the bell-wire ends are clean.

After longer periods of use, say, every eighteen months, the cells should be emptied out and washed with clean cold water. Afterwards refill with concentrated sal-ammoniac solution, in the proportions of 5 oz. to the pint of water. The sal-ammoniac tabloids sold by most chemists and hardware merchants are the most convenient for this purpose; they should be dissolved in warm water. It will usually be found that the zinc rods will require renewal at this period, as during the normal working of the cell the zinc is eaten away. Spare zinc rods can be obtained at hardware shops.

After a few years of normal use and proper maintenance, it will usually be found that the cells become partly exhausted. In this case the porous pot and its contents (including the carbon rod) must be replaced with a new one. The solution should, of course, be renewed on this occasion, and, as previously mentioned, at regular intervals.

Finally, the cells should be placed in a dry place (preferably in a cupboard or on a shelf), and protected against dust and dirt by enclosing in a readily removable box or casing. Do not place the cells in too warm a position, otherwise the solution will evaporate quickly.

Substitute for Sal-Ammoniac.—It may not be generally known that common salt (sodium chloride) is a cheap, convenient, and effective substitute for ammonium chloride (sal-ammoniac) in a Leclanché cell—the usual cell for use with door bells, etc. The solution should not be too concentrated.

LIGHT BULBS, COLOURING

During the festive season the question of table, room, and Christmas-tree decorations assumes some importance. In this matter it should be noted that small electric bulbs of the automobile type can be used from a battery or in series from the mains, and some excellent effects obtained by colouring them in the following manner:

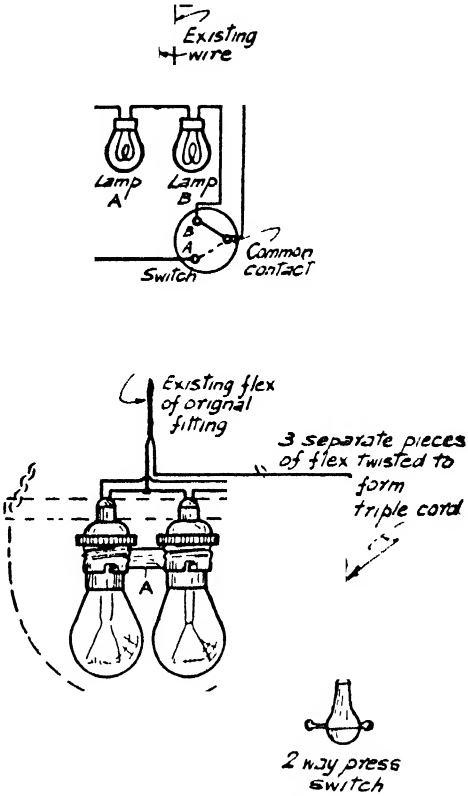
Dissolve 2 or 3 per cent. of celluloid sheet or celluloid chippings in amyl acetate, and colour with suitable aniline dyes for red, green, blue, and yellow effects. If it is desired to produce a frosted effect, add a small quantity of magnesia to the varnish.

LIGHTING ARRANGEMENT

In some of the smaller houses the rooms are not always wired for more than one lamp point, a single current controlled by one switch often being employed. Where one does not wish to go to the trouble and expense of altering the wiring in walls and ceiling, the following expedient may be useful, providing as it does the choice of two different-powered lamps, often desirable, and also economical. If the illumination is carried out by a bowl or large shade, the method is particularly adaptable, as depicted

in sketch. The idea is simplicity it self; all the extra fittings required are a *two*-way pear switch, an additional lampholder, and some flex. The original lampholder is removed, and, with the extra accessories, is wired as per diagram.

The press switch may hang a few inches below the bowl or shade, so as to be conveniently reached. Lamps of high and low wattages may be inserted in the two holders, and either is available by moving switch control to one or the other of its two positions, which is obviously a useful arrangement. The existing tumbler switch may still be used as before, no alteration being required. The diagram and sketch should make the idea quite clear.



Electric Lighting Arrangement.

MAINS RECEIVERS

Apart from the amateur-built A.C. or D.C. mains receivers that appear to be still in use today, and need special consideration when faults develop—according to the circuit and components used—the overhaul of the modern receiver is outside the skill of the ordinary householder, on account of its involved circuits and construction. There are, however, certain minor items that may be attended to in case of troubles arising, namely, as follows:

(1) *Faulty Aerial or Earth Connections.*—These connections should be examined, cleaned and tightened, if necessary.

(2) *Faulty Mains Supply Plug, Socket* or *Cable Connections.*—This will cause crackling or the set may switch off occasionally under vibration conditions.

(3) *Faulty Valve.*—If the above items have been checked and found in order, noisy reproduction or complete cessation may be due to a faulty valve. The procedure is to substitute a similar type of valve which is known to be sound, in each position, and note the results. This is, usually, the first thing the wireless service engineer checks on a faulty set.

(4) *Excessive Hum.*—This is due to a breakdown in the rectifier smoothing arrangements and is generally due either to a faulty smoothing choke or one of the large-capacity smoothing condensers. The amateur wireless user is able to check the choke for continuity of its winding, or the condenser for breakdown, with a headphone and small battery and to thus

ascertain the faulty component. Usually, however, the ordinary user must call in the services of a radio expert.

(5) *Falling-off in Performance.*—If this occurs in fairly new receivers the agents should be informed as this is a sign of a definite fault, e.g. a poor valve. If, however, this occurs only after two or more years' regular usage, it is very probable that one or more of the valves require renewal. It is advisable, before making a decision, to check items (1) and (2).

Apart from the enumerated possible faults, if the receiver breaks down or gives intermittent trouble it is then necessary to consult a radio expert, i.e. the manufacturers' local agents.

MOTOR

This small motor may prove of interest to junior readers, as it takes but little time to construct, and costs only a few pence or so for a steel magnet, to be found on a "junk" stall.

Fig. A gives a complete view of the finished article, and shows how the magnet and back armature bearing, or L-shaped brass strip, are held down to the wooden base by means of a wood cross-piece and two c.s. screws.

The front armature bearing is another L-shaped piece of strip brass screwed down as shown.

The "armature" is a cotton reel in which three slots ($\frac{1}{4}$ in. wide) are cut in each end, pushed on to a wooden spindle having a short piece of steel wire driven in each end, to revolve in holes drilled in the previously mentioned bearing supports.

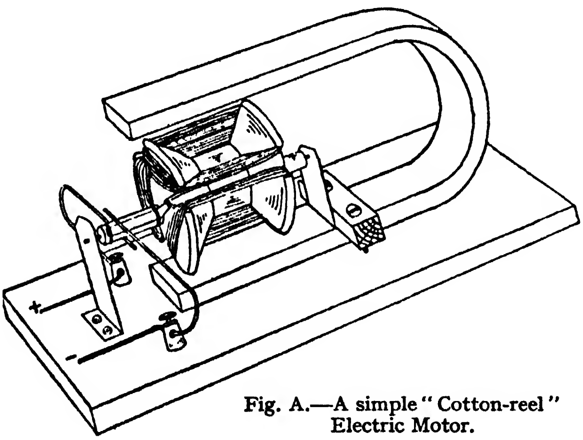


Fig. A.—A simple "Cotton-reel" Electric Motor.

The three commutator bars are of O-shaped brass strips secured to the spindle, opposite the slots, by a binding of thread at each end.

The windings (Fig. B) of 24 d.c.c. wire should fill the slots, and are, of course, attached to the short arms of the commutator bars. The winding diagram should make the method of winding quite clear. The "brushes" are simply lengths of No. 24 copper wire (bared) held in position by the terminals shown in the drawing.

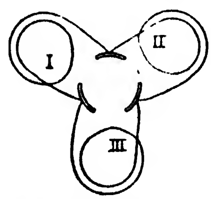


Fig. B.—Showing the Windings of Electric Motor.

The motor constructed worked excellently off a flash-lamp battery, and improvements to its appearance could readily be made by the application of a little varnish and paint to the baseboard and magnet respectively, and by treating the windings to a coat of shellac. The commutator should not be shellacked. A little oil should be given to the bearings.

SWITCH, BEDROOM LIGHTING

It is an easy matter to convert the ordinary ceiling type of electric light operated by the usual tumbler switch near the bedroom door into a much more convenient arrangement, whereby a pear switch on a flexible lead can be used.

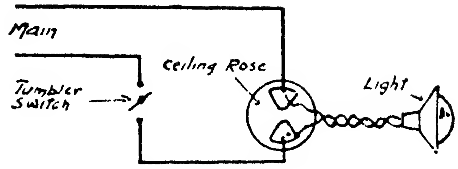


Fig. A.—Bedroom Light Arrangement.

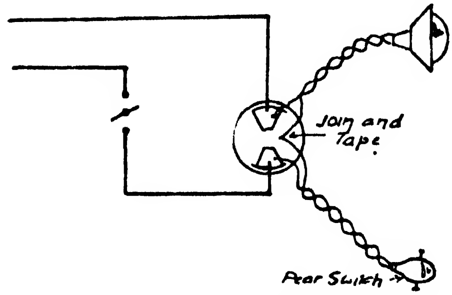
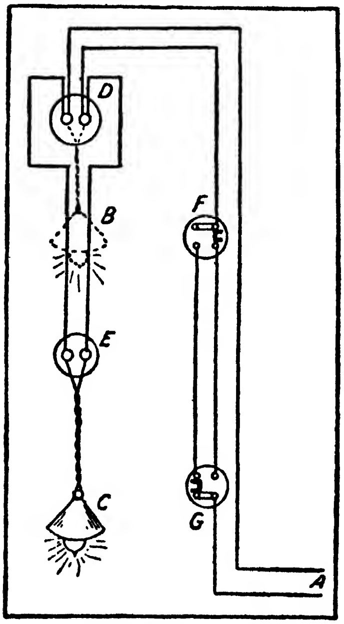


Fig. B.—Improved Lighting System.

The pear switch in question can be placed over the bed so that the light can be switched off whilst one is in bed.

On examination of the ceiling rose it will be found that there are two terminal plates, with a terminal on each to which the wires from the lighting cables are attached. The flexible wires which hold the lamp holder are also attached to these plates. To carry out this light rearrangement, obtain a length of twin flexible wire to stretch from the ceiling rose to a ceiling eye (this is a kind of insulated hook which is screwed into the ceiling immediately over the head of the bed) and down to the bed-rail to some convenient position within reach of a person in bed. Obtain also a pear switch and attach to one end of the twin flexible wire (commonly known as twin flex). The method of attaching this is readily seen on examining the switch. Now take the cover off the ceiling rose and disconnect *one* of the flexible wires from which the light hangs, and in its place connect *one* of the flexible wires from the pear switch. The other wire from the pear switch and the wire just disconnected are joined together and taped, first with rubber and then with Blakeley—or black, as it is sometimes called—tape. On referring to Figs. A and B, the change-over is readily seen.

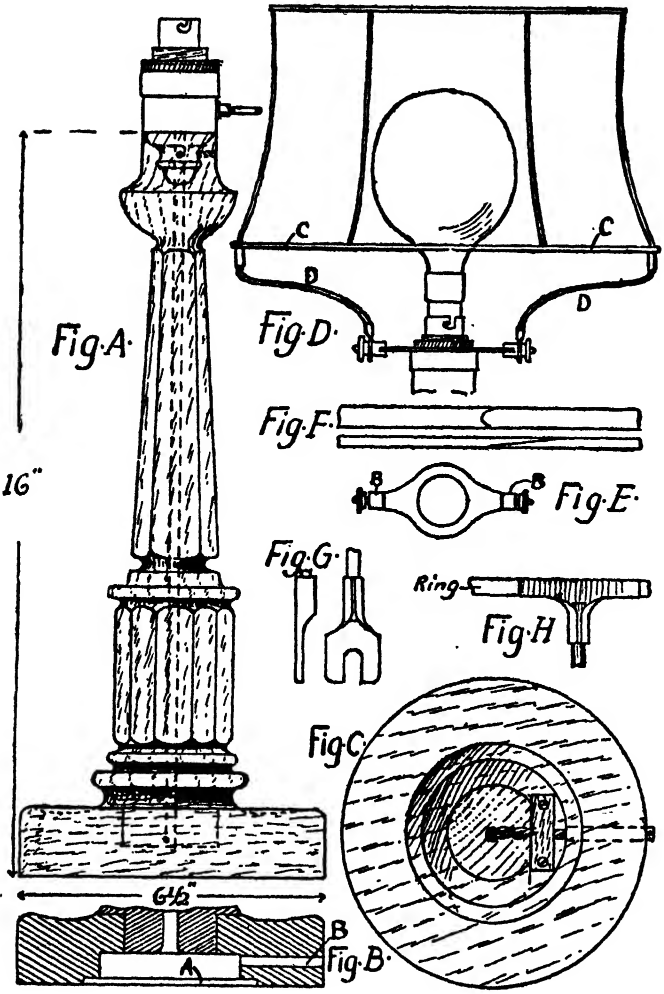


A Two-point Electric Switch.

SWITCH, TWO-WAY

It is very convenient to be able to control two staircase lights from either of two floors. The attached wiring diagram shows the necessary circuit arrangements, between the service wires A coming from the distribution fuse board, to the two lamps B and C. These are suspended from ordinary two-plate ceiling roses D and E. One service wire is looped

into one terminal each of D and E, and the other terminals looped back to the linked side of the first two-way tumbler switch F. The remaining service wire is taken to the corresponding linked side of the second two-way switch C, leaving the two intermediate switch terminals to be interconnected as shown. All wiring throughout to be $\frac{3}{32}$ s.w.g. 600-megohm V.I.R.



Constructional Details of Electric Table Lamp.

Fig. A.—Lamp Stand with Holder fitted. Fig. B.—Section of Base. Fig. C.—Securing Flex in Base. Fig. D.—Shade Fitting secured to Carrier. Fig. E.—Plate for Shade Fitting. Fig. F.—Scarfed and Soldered Ring for Shade. Fig. G.—Spade Clip for Shade Support. Fig. H.—T-clip for Ring.

TABLE LAMP

The electric table lamp stand shown in Fig. A was shaped from an old table leg fitted into a turned base. The original shape of the table leg determined to some extent the design of the stand, which, whilst not elaborate, is fairly pleasing to the eye. As the turning is simple nothing more need be said about it. The base was hollowed out as shown in the section Fig. B and fitted with a plywood cover A, secured with three screws. Through the side of the base a $\frac{1}{4}$ in. hole B was drilled to come in to the hollow base. The top of the stem was hollowed out to take an ordinary hanging lampholder, which in this case was fitted with a switch. This holder was secured in the following manner. At a distance of $\frac{7}{16}$ in. from the top three equidistant holes were drilled to take three No. 7 wood screws. These had the points filed blunt so that they pinch the lampholder as shown by the dotted lines. When wiring the stand the wires to the lamp-

holder are finished off and passed through the centre of the stand and pulled tight; whilst tight the screws are driven in to grip the holder. Afterwards the heads are filed off and the projecting ends filed level with the wood. The wires are secured in the hollow base by means of a wooden clip as shown in Fig. C, the ends being passed through the hole in the base to be fitted with a plug to enable it to be connected to any electric light adapted. A suitable movable shade fitting was made as shown in Fig. D. A piece of $\frac{1}{16}$ in. sheet brass was shaped as shown in Fig. E, and the terminal screws B soldered to each end. These are screwed 2 B.A. and carry the terminals, the inside ones being soldered to the screw. This arrangement is secured under the shadeholder screw ring on the lamp holder. The ring C is of half-round brass with the ends scarfed as shown in Fig. F and soldered. The supports DD are soldered at the bottom end to a spade clip as in Fig. G, the top end being fitted with a T clip which is fitted to the ring C, Fig. H. From this stout ring any shape of wire shadeholder can be built up; a simple example is shown. Reference to the shades in the windows of the electrical shops will be of assistance in designing the shape of the shade.

TELEPHONE BELLS, HOW TO SILENCE

One of the troubles of telephones in ordinary houses is that, owing to their having to be placed in the hall as a rule, they are apt to disturb the occupants at night—particularly if there are children. Also the noise of a telephone bell close at hand is startling to some people. To get over this difficulty, it is only necessary to obtain one or more of those rubber door wedges sold at most bazaars or hardware shops. If the wedges be attached by a chain or string they can be removed when the bells do not require silencing, and kept handy.

TELEPHONES, DOMESTIC, PRINCIPLE, AND SIMPLE TYPES

A telephone for inter-room communication or from one building to another can readily be installed by the home handyman, once the principles have been studied. The simple installation depicted in Fig. A enables a person in one place to talk to another person a good distance away, but the latter cannot talk back. The circuit contains a bell at the receiving end to call up the person at that end. The apparatus required include: a microphone transmitter (this can be a single ear-piece of a headphone); a receiver (or pair of headphones); a 2 or 3 cell Leclanché primary battery (or 4 to 6 volt dry battery); an ordinary electric bell; two switches and sufficient insulated or bell wire.

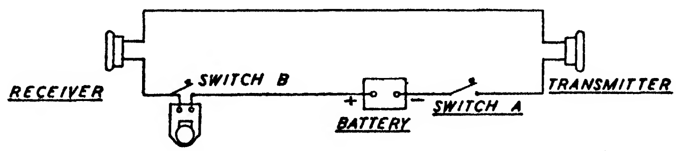


Fig. A.—A Simple Domestic Telephone System.

The connections should be as shown in Fig. A. When it is required to call up the person at the receiver end, the switch B being open, the

caller closes his switch A and speaks into the receiver, when the bell will ring at the latter end. The receiving-end person then closes his switch B (to stop the bell ringing) and thus completes the sender-to-receiver circuit for listening. It is advisable to have the switches A and B of the type requiring constant hand pressure on a spring to make contact. Thus, when released by the operator the switches open to the "off" position, automatically, thus disconnecting the battery and leaving the bell in circuit ready for the next call.

Fig. B shows the circuit for a simple house telephone system, so that persons at either end of the circuit can both speak and listen to one another. It includes a bell at each end so that either person can be called up.

The combination-pattern receiver-transmitter telephone similar to the older post-office type is used at either end. It is hung on a hook at the end of a switch and such that when on the hook it pulls the arm

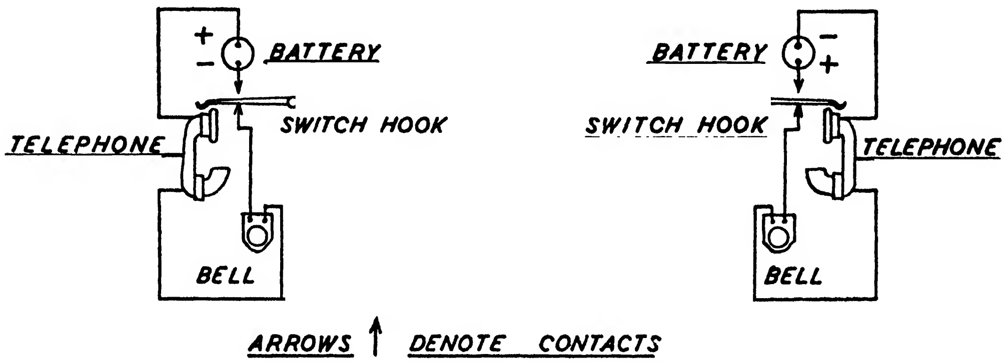


Fig. B.—Simple House Telephone Arrangement.

down and makes contact with the bell contact, and when the telephone is lifted off the hook the spring arm moves up to make contact with the battery contact.

Thus to call up a person at the other end, the caller merely lifts his telephone off its hook, when the bell will ring at the other end; actually the caller can hear this bell ringing and then knows that the circuit is satisfactory. The receiver lifts his telephone off its hook and this breaks the bell circuit and makes his own battery circuit. It will be noted that the batteries at each end are connected the reverse way round. This is on account of the necessity for providing speaking current.

TELEPHONES, DOMESTIC, THEIR ERECTION AND MAINTENANCE

Broadly stated, telephone installations are separable into three distinct classes :

(1) The C.B. (common battery) System; in present use on all the great Public Exchanges.

(2) The Induced Current System.

(3) The Direct Current, Series, or "Domestic" System.

(Many variations of detail occur in all these systems, but without alteration of their ruling principles.)

No. 1 *System* may be dismissed from consideration here, because the average amateur has no more concern with its complicated detail than he has with the engineering departments of his main water, gas, or electric supplies.

No. 2 *System* is applicable to any installation the stations of which are separated by distances exceeding, say, 150 yards.

No. 3 *System* is that with which this article is chiefly concerned. It is the cheapest and simplest to erect and to maintain. It has certain limitations other than that of distance, but it adequately fulfils not only all the domestic needs of small private houses, but serves well in great business premises, factories, hotels, etc.; in which most of the stations are assembled under one roof, or scattered over half an acre of land.

Comparison of Principles.—The distinction between systems No. 2 and No. 3 should be grasped at the outset; it subsists, essentially, in the inclusion or the absence of a small induction coil in each apparatus.

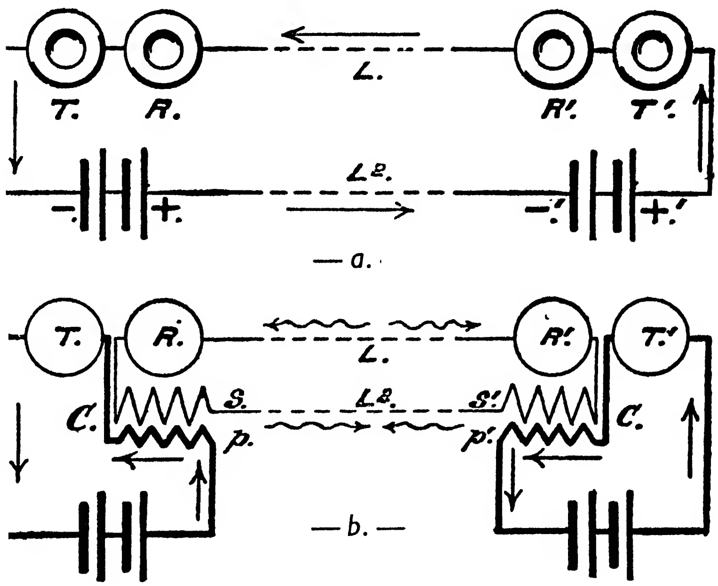


Fig. A.—Theoretical Circuit Diagrams.

This difference is conveyed at a glance by diagrams *a* and *b*, Fig. A, which "skeletonises" the speaking circuits, respectively, of a pair of stations connected by line wires L; all accessory detail being omitted.

In diagram *a* one has No. 3 system, in which T, T^1, are the microphone transmitters; R, R^1, are the receivers (usually associated in one hand combination, see Fig. B, (*a*). + —, $—^1$ $+^1$, are the batteries and L, L^2, are the lines.

On this simple circuit, the (unidirectional) current, originating (say) at the carbon pole ($+^1$) of the right-hand battery, flows through T^1 R^1 and line L to R, T, and through the left-hand battery, — +, whence (reinforced in strength) it returns by L^2 to the zinc pole ($—^1$) of the right-hand battery (here assumed to be its propagating source).

The terms "Direct Current" and "Series" thus explain themselves;

the (hypothetical) "flow" of current following the *direct* line of the arrows throughout the *series* of batteries and instruments.

Diagram *b*, Fig. A, shows No. 2 system, in which C, C, are the induction coils, *p* and *s* being the primary and secondary windings of the same. In this case it will be observed that the battery current does not flow along the line wires, or through the receivers, but is wholly isolated from them and purely local to itself at each station; traversing the primary coil *p*, and the transmitter T, only; as indicated by the heavily drawn lines and straight arrows. This low-tension battery current, being caused to fluctuate rapidly by the sound waves of speech impinging on the flexible diaphragm of the carbon transmitter T, in the local circuit which includes the primary coil *p*, induces (creates) momentary impulses, at high tension, in the secondary coil *s*; which pulsations of alternating current radiate in both directions around the outer or long-distance circuit formed by the line wires L, and the receivers R. (This distance circuit is suggested by the thin lines and waved, reversed arrows of the diagram.)

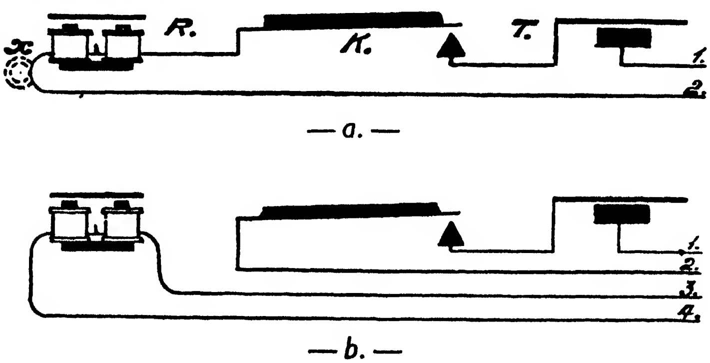


Fig. B.—Interior Connections of Hand Telephones.

Apparatus.—(1) *Hand Telephones.*—These familiar instruments vary in detail, though bearing a general resemblance. There are several types, of which the two here concerned are indicated in Fig. B, *a* and *b*. For clearness' sake the receivers R are shown as magnets and armatures, and the transmitters' diaphragms and buttons as lines and rectangles T. K are the grip keys which, when depressed, make contact with the points shown as pyramids.

Type *a*, Fig. B, is for the Direct Current System; it is connected to its "station" (a wall rosette or table set) by a two-conductor flexible cord. The grip key K being pressed down, current enters, say, by terminal 1 and passing through the granules of the transmitter T, and the magnet windings of the receiver R, in direct series, returns to its source via terminal 2. In some patterns the suspension ring *x* is in metallic connection with conductor 2 (for the purpose explained below), in other patterns the ring has no electrical significance.

Type *b*, Fig. B, is for the Induced Current (long-distance) System. It is connected to its station by a four-conductor flexible; primary direct current enters and returns through terminals 1 and 2, alternating current circulates by terminals 3 and 4.

(2) *Stations.*—These comprise the telephone itself and a fixed or semi-portable automatic device to which it is attached by the flexible conductor; a push, call bell, and battery complete the station.

The simplest possible station consists of a wall rosette and separate electric bell. A rosette of the kind is shown in detail at Fig. C, *a*; its hand telephone *hc* suspended on the fixed hook *h*, the ring *x* making electrical connection therewith. The twin conductor flexible cord *f* is indicated in broken lines and the interior connections in solid lines, through which the current paths (both ringing and speaking) can easily be traced in association with the wiring diagram *a*, Fig. E. *k* is a Morse key, or two-contact calling-push, usually placed in the centre of the rosette.

Fig. C, *b*, is a superior class of instrument which includes a self-contained call bell and automatic switch hook *ah*, in place of the simpler rigid hook and surface contact ring *h*, and *x* Fig. C, *a*.

These two rosette sets (*a* and *b*), for direct current working, are typical of those sold (complete with telephone) by all leading firms at moderate prices, but amateurs possessing spare telephones and wishing to install them cheaply can easily make their own wall sets at the cost of a few pence by adopting the "C.H." design shown at Fig. D, which was specially devised by the present writer for home construction by unskilled workers.

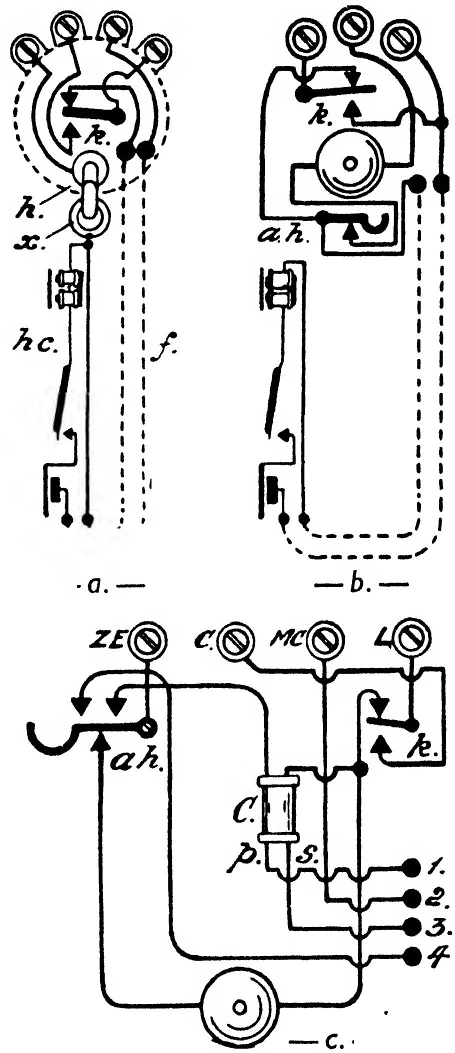


Fig. C.—Interior Connections. Three Types of Wall Telephones.

Fig. C, *c*, however, must be first described. It shows the interior connections of an ordinary induction coil wall set, for long-distance working (System No. 2). The terminals (of British-made instruments) are usually lettered in the sequence shown ZE (zinc and "earth"), C (main carbon pole of battery), M C (microphone carbon), and L (line wire).

k is the ringing-key, *ah* the automatic hook, with three contacts. C is the induction coil, *p* and *s* being its primary and secondary windings and 1, 2, 3, 4, are the studs to which, numerically, the four conductors

of the flexible cord are attached, connecting the apparatus to a telephone of type *b*, Fig. B.

As in the case of the simpler (direct current) sets, the exterior wiring of lines and batteries is made clear by the installation—diagram *c*, Fig. E.

The " C.H." Wall Set is seen at Fig. D; certain details having been modified since its first introduction to amateur workers.

Construction.—The baseboard is a 4 in. square of ½ in. mahogany, teak, or other non-warping wood, surrounded by ⅜ in. by ⅜ in. fillets of the same, mitred, glued and pegged on. A detachable cover-board of ⅛ in. or ¼ in. stuff, screwed on, completes this shallow box, preserving the metal parts from injury. Before gluing on the fillets, the latter should be slotted to receive the line wires L, L_2; the bell wires B, B_2; the battery wires +, —; the hook stem; the H combination flexible cord, and the lever of the calling-key *k*. Being finished, both box and cover should be saturated with paraffin wax (applied with heat) to exclude damp; then varnished, or french-polished.

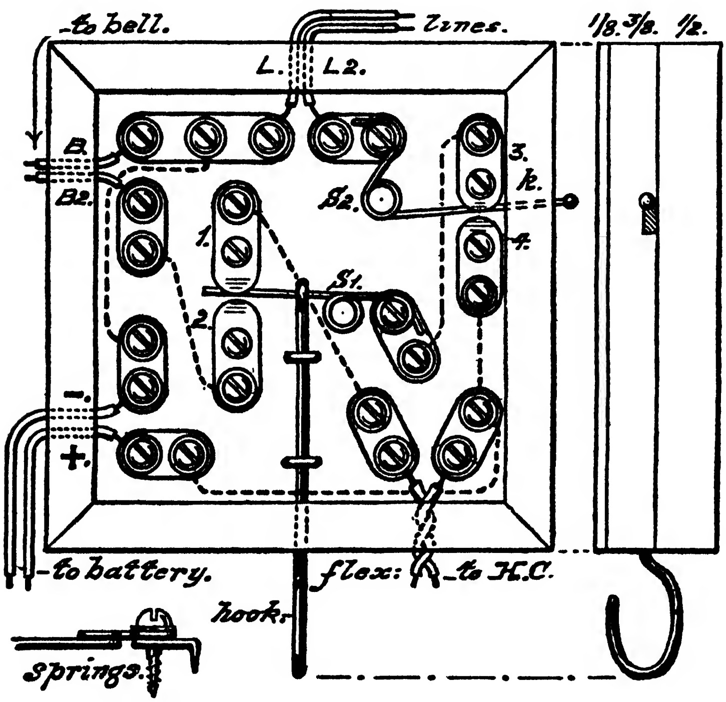


Fig. D.—The " C.H." Wall Set Arrangement.

The terminals, contact plates, etc., are strips of sheet brass, ⅜ in. wide, with rounded ends. Seven of these are of the same length (¾ in.), four others are ⅞ in. long, and one is 1½ in. long. After cutting from the sheet and flattening, the sets of seven and of four, respectively, should be packed together, wired tightly, and temporarily sweated with solder. The assembled blocks can then be drilled and filed to shape (ensuring uniformity), melted apart, wiped free from solder and finished by glass-papering bright. Two of the smaller plates require an additional hole to receive the spur ends of the springs S_1 and S_2.

Springs 1 and 2 are of hard-drawn brass wire, No. 12 or 14 gauge; they are easily formed, as shown, by binding round the stems of two

stout wood screws, driven two-thirds of their length into the work bench. (Details of a spring, its down-bent spur, its fixing screw and washer, are seen below the main figure on the left.)

Terminal connections are formed by stout-gauge, round-head, brass wood screws, $\frac{1}{2}$ in. long, passed through brass washers, the looped wire ends being clamped between the washers and the plates.

The broken lines in the diagram indicate the wire connections between the several plates. These should be carried through holes drilled in the baseboard and taken from point to point in deeply incised grooves cut in the back of the board. The wires (No. 20 gauge copper) being laid in the grooves, the latter are filled with sealing-wax, levelled with a heated iron.

When assembling, springs S_1 and S_2 should be given a strong upward bias; jamming them into close metallic contact with the out-turned tips of contact plates 1 and 3, respectively.

When the telephone is suspended on its hook, its weight pulls down S_1 from connection with contact 1 and jams it firmly under the tip of contact 2. Similarly, the lever of the calling-key *k* being pressed downward, breaks contact with 3 and instates it with 4. (These movements ensure a so-called "rubbing contact" which maintains a bright, conducting surface by the friction of constant use; dispensing with "dot" surfaces of platinum or other costly metal.)

The hook itself may be of stouter gauge than the springs, say No. 10 or 12 gauge brass; it is looped to enclose S_1 and may or may not be soldered to the same. It slides easily under the two lightly driven staples shown.

Although so cheaply and easily made, this wall set is efficient and durable beyond the average commercial set; its design, moreover, renders impossible the errors of connection to which novice linesmen are prone.

Circuits.—Three simple installation circuits are seen at Fig. E. Diagram *c* is that of a pair of induction-coil (long-distance) instruments of System 2, the interior connections of which appear at *c*, Fig. C. Comparison of the two *c* diagrams will permit of a complete current trace being followed throughout the system, making further description superfluous.

Bridge Connection.—The dotted outline of a third instrument between the others explains the "bridging" method (seldom adopted in this country) by which three or more stations can share one pair of lines in common.

Necessarily, bell calls sent by any one station sound the bells of all, so a code of signals is prearranged to indicate the station required. There is no privacy of communication; any station may overhear, or take part in, a conversation between two others merely by unhanging his telephone. Technically, also, "bridging" is unsatisfactory (except with instruments specially designed for it) because current impulse is

split up and both bell signals and speech become progressively feebler as stations are added in parallel across the lines.

Fig. E, *a*, explains the local and line wirings of two stations equipped with detached electric bells and the rosettes detailed at *a*, Fig. C. This arrangement is efficient and extremely popular, but owing to the slight complication of the connections (line L passing from rosette to rosette, line L2 from bell to bell, bells to batteries, etc.) it is the combination which appears to confuse the novice linesman above all others of its elementary sort; even though he may have had the sale diagram before him at the outset!

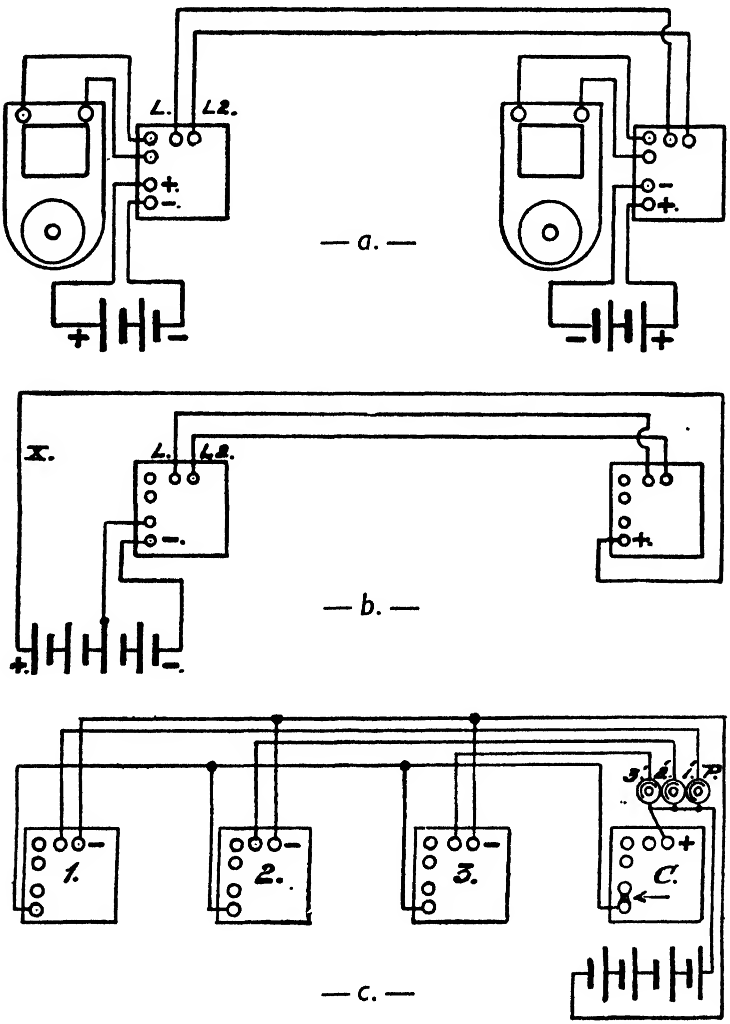


Fig. E.—Wiring Diagrams for Standard Apparatus of Three Types.

It was, indeed, mainly on account of the innumerable press queries addressed to the present writer relating to troubles arising out of errors of connection made with these detached bell rosettes, that he designed the simple wall set since identified by his initials (see Fig. D), which eliminates all risk of misconnection.

Fig. E, *b*, gives the local and line wiring of the self-contained bell sets (British-made) detailed at *b*, Fig. C. The bell dome encloses the whole movement; the suspension hook being below it and the press key to the right. No neater or more efficient arrangement could be desired.

Fig. F, *a*, *b*, and *c* are wiring diagrams for the home-made set, Fig. D. (It lends itself readily to a great number of other combinations, according to requirements.) The ordinary paired connections are seen at *a*,

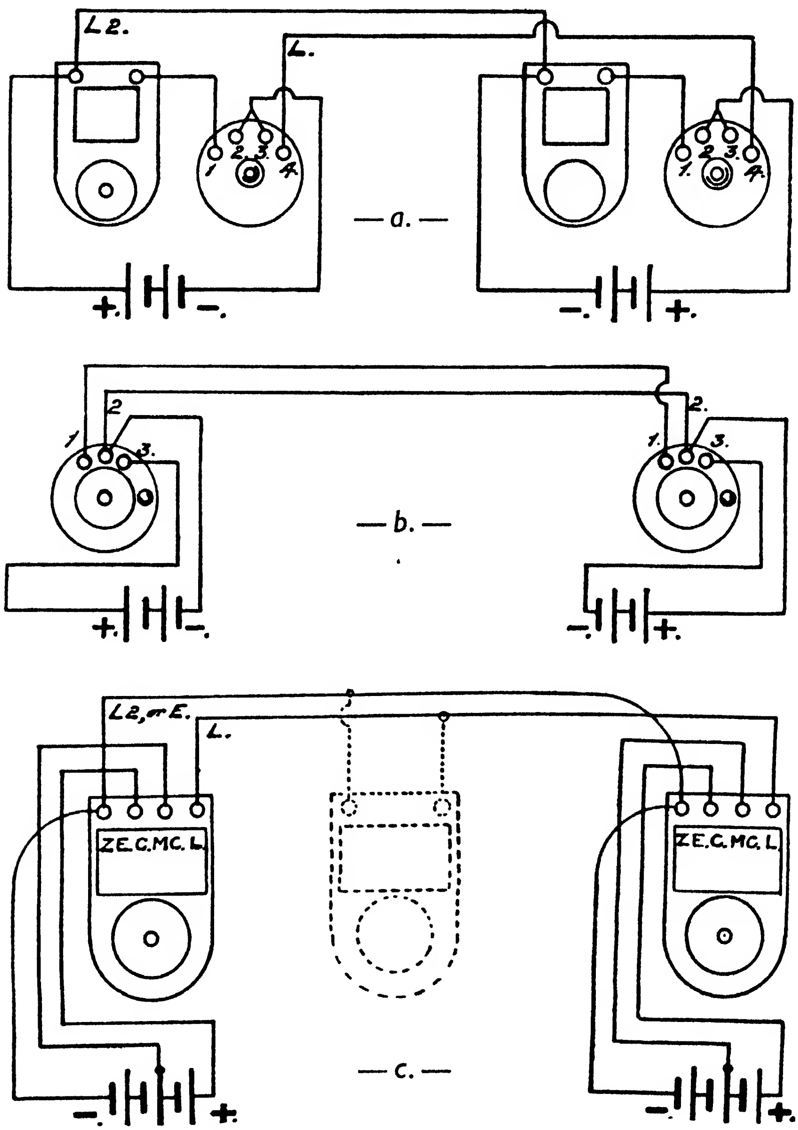


Fig. F.—Wiring Diagrams for the " C.H." Wall Set.

one two-cell series battery being installed at each station. Diagram *b* shows a pair of stations served by the two batteries combined in one four-cell series; at one or other of the stations; which necessitates the running of an extra line (X) between them. This arrangement is useful in

cases where the presence of a battery at one of the stations (say a sitting-room) would cause inconvenience.

Multiple Connections.—Diagram *c* presents a more elaborate application of this adaptable wall set. Four stations (or more) are interconnected and served by one four-cell battery; the facilities afforded being as follows:

The Central or Master Station C can call up any one of the subordinate stations, 1, 2, 3, individually, without disturbing the others, by means of the ordinary pushes P, similarly numbered. The subordinate stations can call Central, but not one another.

It is always at C's option to call more than one of his correspondents, simultaneously, to share in a conversation; or all the stations can be summoned by him to a general conference. Privacy is not provided for, but should C be in conversation with one station and another station telephone were unhooked to listen in, both C and his correspondent of the moment would be made aware of the fact by a thud heard in their receivers.

Remarks.—Attention is particularly directed to the following points:

Reversal of Poles.—In all paired stations of the "Domestic"-type instrument (see diagram *a* and *b*, Fig. E, and also *a*, Fig. F) it is essential that the battery poles (+, carbon, and —, zinc) shall be applied to the wall sets in the reversed order indicated by the *plus* and *minus* signs of the diagrams. At *a*, Fig. F, for example, the — pole is connected to the upper terminal and the + pole to the lower one, at the right-hand station. At the left-hand station this order is reversed. The same conditions obtain in diagrams *a* and *b*, Fig. E, and should be most closely observed when wiring up. (Confusion, here, might permit the call bells to ring, but would render the speaking circuit deaf and dumb.)

The same "trap for the unwary" exists in installations *b* and *c*, Fig. F. It will be noted that *c*'s general connections differ entirely from the others; that certain terminals are left vacant of connection and that the battery terminals of Central are coupled together (see arrow) by a brass strap or short wire. The diagrams, however, are accurate and can (if need be) be blindly followed to a satisfactory issue.

The space allotted to this contribution being almost exhausted, it must conclude with a few

General Hints.—*Batteries.*—For permanent installation "wet" (and not "dry") Leclanché cells are strongly recommended. For small installations, the one-quart capacity cell suffices; for busy lines, the three-pint size should be the minimum. Old cells should never be used. New ones, while still dry, should be prepared by greasing the interior of the glass jars 2 in. down from the brims. The upper portions of the porous pots and of the zinc rods should also be greased, but no trace of grease must soil the parts below liquor level. (The grease may consist of one part of pure paraffin wax, melted by gentle heat, to which five

parts of unscented vaseline are added and stirred in.) The electrolyte should be of 10 per cent. density, no stronger and no weaker. A quarter-pound of sal-ammoniac crystals (not pulverised) in one quart of distilled water (or boiled rain-water) gives the correct strength. Mix warm in a separate vessel; allow to become quite cold before pouring into the cells with the aid of a glass funnel, to avoid splashing. When the elements are in place the jars should be two-thirds full. Connect the cleaned wire-ends to the cleaned terminals with dry, clean hands, then grease the terminals and all exposed metal. *Solder* the line wire to the terminal zinc rod (a twisted joint will corrode sooner or later). Insulate the joint, or heavily grease it.

Replenishing.—After some months the electrolyte may have shrunk by evaporation : then add *plain water only* (never make up with sal-ammoniac solution, nor add more crystals). Install the cells in a dry and cool place.

Line Wires.—Never use old wire, however sound it may appear. The minimum gauge should be No. 20 s.w.g., and the insulation i.r.d.c.c. (india-rubber, double cotton-covered). Plain cotton-covered line is wholly inadequate, even in dry situations; in damp ones, leakage and corrosion troubles may commence within a few days after installation. Take the lines by the shortest possible route, never secure two wires by one staple, and drive all staples lightly, or the insulation will be damaged. All joints must be *soldered* (with resin flux and no other), the insulation being carefully made good.

In complicated installations use wires having distinctive coverings, to permit of easy identification at the instruments and batteries.

TELEVISION INSTALLATION

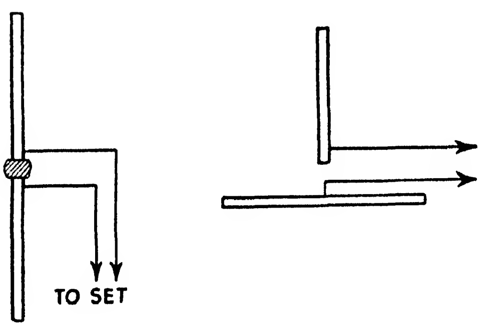
The installation of a television set presents more problems than does that of an ordinary radio receiver. There are several reasons for this. The most important is that the set works at a much higher frequency and must accordingly be fitted with a special type of aerial. The next is that television reception is subject to several types of interference that do not seriously affect other sets.

High-frequency Effects.—Radio programmes on the medium waveband are received by sets that respond to wavelengths from 200 yards or so to over half a mile in length. These comparatively long waves travel round obstacles such as large buildings or hills without difficulty. Television programmes, however, are radiated at much higher frequencies, the wavelengths being only 5 to 10 yards long. These short waves cannot easily pass large objects; houses and hills may form very effective barriers and may also act as reflectors. The wavelengths are so short that they can be noticeably deflected by an object as small as the human body or a passing vehicle. This being so, it is important to fix the aerial where it will be able to receive a signal free from disturbance and then

arrange that this signal shall be conveyed to the receiver without serious loss.

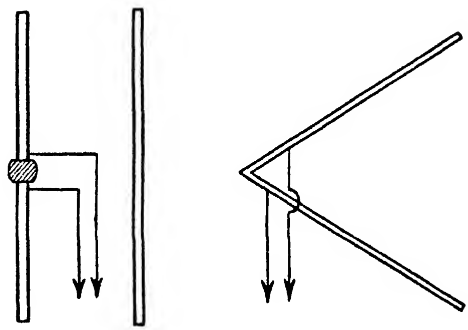
Types of Aerials.—Because of the short wavelength, aerials can be physically smaller than those intended for broadcast use, though electrically they are longer. This apparent contradiction is due to the fact that radio engineers use the length of the wave transmitted as a standard of aerial size. For simple aerials the best length is half that of the wave transmitted, and the aerial is then called a half-wave one. The next best size is quarter wavelength, followed by eighth wavelength.

The method of connecting the aerial also affects matters. A half-wave aerial is generally a dipole, shown in diagram in Fig. A (1). The quarter-wave aerial is shown at (2). Either type may be mounted vertically or horizontally and either type, by itself, will receive equally well from any direction. The aerials may be modified so that they receive best in only one direction. This is effected either by fitting a reflector to the aerial



(1) (2)

Fig. A.—Diagram of a Half-wave (1) and Quarter-wave (2) Aerial.



(1) (2)

Fig. B.—Half-wave Aerial and Reflector (1) and V Aerial (2).

or by modifying its shape so that the aerial acts as its own reflector. Fig. B shows ways of doing this; (1) is the dipole of Fig. A with a reflector, and (2) shows two quarter- or eighth-wave aerials arranged to be directional; The half-wave aerial receives best when the cross-bar is pointing towards the transmitter with aerial at the front end. The quarter-wave receives best when the V is in line with the transmitter. The use of a reflector not only increases the signal strength at the receiver, but helps very materially in reducing interference.

The more complex the aerial structure the more expensive it becomes. Simple indoor aerials are quite adequate at short distances from the transmitter. As a guide it may be taken that a simple quarter-wave aerial fixed in the roof or attic will give good results up to roughly 5 miles from the transmitter. The same aerial fixed on the chimney will be effective at 10 to 15 miles. A half-wave dipole, chimney mounted, will be reliable at 15 to 20 miles. Beyond that distance a half-wave dipole and reflector will be advisable.

Feeding the Receiver.—The signal received by an aerial is not normally conveyed to the receiver by a single wire. Instead of the familiar "lead in," various forms of twin conductor are used. The reason for this is as follows: A half-wave aerial is usually centre fed (see Fig. C). The aerial itself is divided in the middle by an insulator, so forming two quarter-wave portions. Suppose now that a battery (b) is connected with one terminal to each portion. No current can flow through the insulator, but at the moment of connecting a small current will flow in each of the aerial rods. This current will die away as soon as the rods are charged. If the battery is suddenly reversed, a larger current will flow, because the rods will discharge through the battery and then recharge in the reverse direction. In practice the transmitter takes the place of the battery, and while radiating it charges and discharges the aerial rods about 50,000,000 times per second. From Fig. C it will be clear that no current can flow appreciably beyond the tips of the aerial, and this is also true when the battery is replaced by a transmitter. The current must, therefore, be a minimum at the tips and a maximum at the centre of the aerial. That implies that the impedance to the flow of current must be least at the centre of the aerial. In practice this impedance always has, for aerials of this type, a value of 60 to 80 ohms.

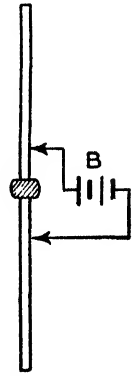


Fig. C.—Diagram illustrating the Current Flow in an Aerial.

In electrical work it is necessary to "match" the impedance of the device to the source of power—a 230 volt lamp must be used on 230 volt

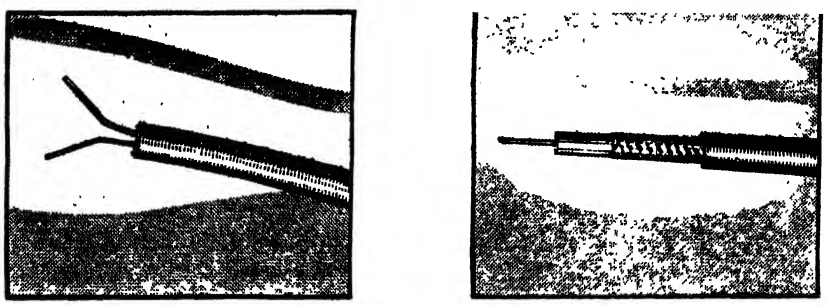


Fig. D.—Types of Feeder Cable.

mains. An aerial such as that of Fig. C will, therefore, be matched when its feeder has an impedance of 60 to 80 ohms. Feeder cable is of two main kinds, balanced twin and co-axial (see Fig. D). The second type, as its name implies, has one conductor inside the other. As the feeder matches the aerial at the point of maximum current large currents must flow in the feeder also. At the receiver input these currents can be fed into a small coil coupled to a larger coil across which the input voltage for the receiver is generated. The scheme then becomes as shown in

outline in Fig. E. The dipole picks up signals from the transmitter. These are conveyed as relatively large currents by the feeder and then converted to voltages by the tuning circuits of the receiver. From this diagram it will also be clear that the normal "earth wire" of a radio receiver is not required because the aerial is a balanced unit. If any earthing is necessary, it will be provided by the maker of the receiver in some such form as indicated by the dotted line, Fig. E.

The reasons for this apparently rather elaborate method of coupling the aerial to the receiver are mainly connected with the very high frequencies involved. The wavelength transmitted is of the order of 20 ft., and the corresponding frequency 50,000,000 or more per second. It is necessary that a normal aerial should be as high above the ground as possible. If this latter requirement is attended to by fixing the aerial to a chimney, it may be several wavelengths from the tip of the aerial to the receiver. A single-wire down lead used under these conditions would cause considerable interference, and movements of either the down lead or objects near it would disturb the receiver. By using a feeder the aerial is coupled to the receiver by a twin wire, each wire carrying currents in opposite directions. The result is that the movement of either the feeder or objects near it produce equal and opposite effects, so there is no disturbance to the receiver. Further, a feeder used in this way acts like a simple resistance; electrically it has no wavelength and can, therefore, be of any required shape or can be run in any direction without affecting either the receiver or the aerial. The losses introduced are extremely small.

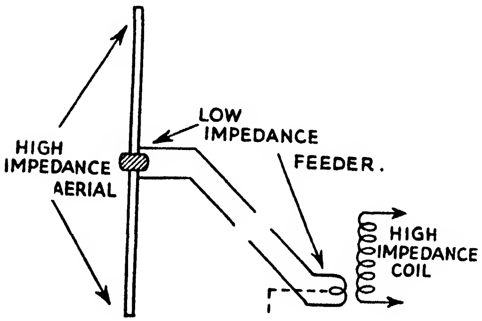


Fig. E.—A Typical Aerial Coupling Scheme.

Aerial Interference.—An aerial system is intended to pick up energy radiated from a transmitter. In television reception the system is designed to respond to one particular transmitter. If other transmitters of similar wavelength are working, the aerial will respond to these too, and several signals may then be passed on to the receiver, resulting in a "dirty" or confused picture. Unwanted signals are commonly classed as interference. The source of this interference may be the transmitter itself, motor vehicles, passing objects, clouds, electrical apparatus in use in the neighbourhood, the electrical wiring of local buildings, or even the general ironwork associated with a building on which the aerial is mounted.

The worst source of interference is usually motor traffic. The ignition system of a car is a relatively powerful transmitter and every time a plug sparks a train of radio waves can be produced, and these may be received by the television aerial. The fundamental cure is to fit sup-

pressor units to the ignition system, but the placing of the aerial can help, as will appear later.

Interference caused by the transmitter itself is almost always due to reflection. Radio waves spread out from the transmitter in all directions, and the aerial generally receives most strongly those that have travelled by the shortest route. Now consider Fig. F, in which T represents the transmitting and R the receiving aerial. In the absence of large intervening obstacles the aerial will receive strongly along the line TR. Now suppose that a high building, hill, or even a gasholder is sited at I. The object is large enough to act as a reflector and, therefore, behaves like an additional transmitter from which a signal reaches the aerial along the path TIR. If this path is appreciably longer than the direct one, the second signal will reach R a small fraction of a second later than the direct one. There will, therefore, be two pictures on the screen, one being a feeble ghost of the other. This ghost image will always be present unless the path TI or IR can be interrupted, or unless the reflected signal can be made so feeble that it produces no significant effect on the screen. Interference of the same general kind can be produced by smaller objects and by passing aeroplanes or clouds, and its presence is to be suspected when the picture shows a series of dark and light bands, either stationary or moving.

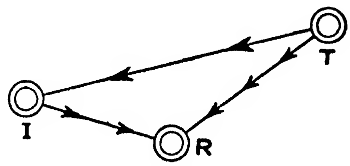


Fig. F.—How Reflections are caused.

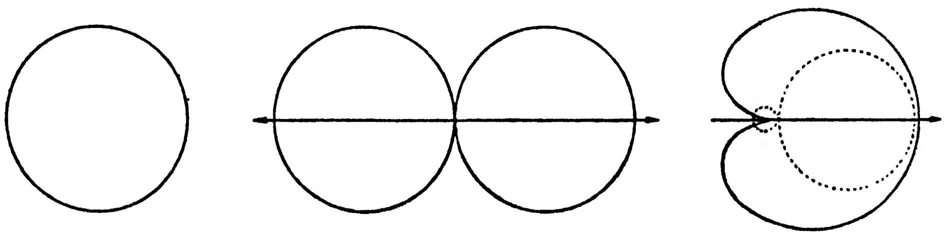
The interference caused by electrical wiring and the ironwork of a building is extremely varied in character, but the fundamental causes are either poor contacts or re-radiation. Any metal object will have currents induced in it exactly as has the aerial. The currents may be induced by sparking switches, thermostats, refrigerator and vacuum cleaner motors—anything, in fact, where interrupted contact takes place. This form of interference shows as random "snowflakes" on the screen, and may be heard as cracks, bangs, and sizzles from the loudspeaker. Raindrops falling on an outside aerial sometimes produce the same effect.

Choosing a Television Aerial.—Having reviewed the usual types of aerials and the interference to which sets are subject, the choice and installation of an aerial can be considered. In the matter of choice, conditions vary so widely that it is not possible to be definite. There is much to be said for the indoor aerial at distances up to about 15 miles from the transmitter. The installation is protected from the weather and is, therefore, more durable and less liable to storm damage.

The siting of the aerial depends on its characteristics. A plain vertical aerial receives equally well from all directions. It should be mounted as high as possible and away from sources of interference. In a busy road it would clearly be best to fix the aerial at the back of the house rather than at the front, so as to place it as far as possible from the interference of passing vehicles. This applies to the V and H types as well, but they

involve additional considerations, as Fig. G shows. The dipole A receives equally well in all directions, so its polar diagram $\frac{\text{signal strength}}{\text{distance from transmitter}}$ is a circle. The V-type aerial B is directional in that it will receive very well in the line of the V, but hardly at all at right angles to this. The H aerial, in the form of a dipole and reflector, has the polar diagram shown at C. It therefore receives best when "looking at" the transmitter and hardly at all in the reverse direction. The dotted curve shows the response for a different frequency. Clearly both the V- and H-type aerials can do much to reduce interference pickup. The ghost reflection of Fig. F would be completely eliminated by an H-type aerial and considerably reduced by a V mounted as nearly square across the line IR as signal strength will allow.

An aerial, then, should be selected to give sufficient pickup first of all. When there is likely to be strong interference, this selection should be



A B C

Fig. G.—Polar Diagrams of Aerials.

modified with a view to reducing the interference as much as possible by making use of the inherent directional properties.

Aerial Installation.—The aerial being chosen, fixing is a matter of following the makers' instructions, but even so the best results demand some thought. A chimney-mounted aerial will usually be far enough from pipes, gutters, and conduit for their presence to be ignored. An indoor aerial is another matter. The V type can be mounted either way up and so lends itself excellently to fitting in the angle of a roof. It should be fixed as far as possible from metalwork and at an angle that provides the best compromise between signal strength and interference suppression. Where a simple quarter-wave aerial is mounted in a room at the side of a window or door, Fig. H, it should be kept clear of any conduit or switch wires. For this reason it is best mounted on the hinged side of a door. A further advantage of this position is that people are less likely to approach it closely and so cause changes in signal strength.

Feeders from the aerial to the set can be run in almost any conventional way. As a general rule they should not be close to or parallel with

metal pipes or the metal framework of a building, and they should not be too short. Short feeders are apt to cause instability in the set. No difficulty is likely if they exceed 10 to 15 ft., so the problem only arises where set and aerial are in the same room. It is essential that the type of feeder advised by the maker of the set should be used.

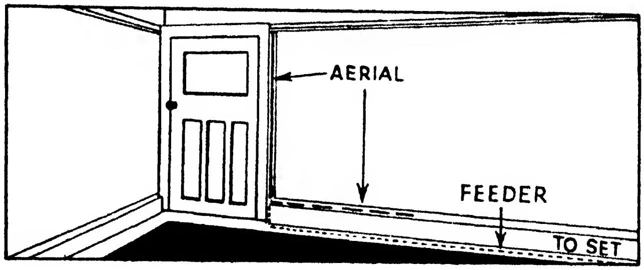


Fig. H.—An Indoor Aerial.

The Receiver.—A television receiver will work in any part of a room, but in actual fact the choice of position is fairly restricted. The effectiveness of the picture depends on its apparent brightness and on the contrast of the various elements. Apparent brightness depends on the level of the surrounding illumination, so, to a lesser degree, does the contrast. It follows that a picture viewed against a low general illumination will appear bright. The cathode ray tube is the most expensive single element of a television set and its life is limited. The possible life can be considerably reduced by running the tube at maximum brilliance. To avoid the need for this the receiver should be mounted in a relatively dark part of the room where direct light from a window does not fall on the tube face. The receiver should not be placed with its back to a window, as the two light sources are then very trying to the eyes. The position relative to any source of artificial illumination should also be given consideration, otherwise reflected light from the tube end may make the picture indistinct.

The receiver should be in a dry position, not subject to the presence of damp air entering through a window for example. It should also be spaced away from the wall so that adequate ventilation and heat dissipation is possible.

Multiple Receivers.—In flats and hotels it is sometimes desirable to run several receivers from a common aerial. This normally requires a special H.F. transformer, but where only two or three sets are involved, a simple resistance connection is possible. Its use causes a loss of roughly half the signal strength, so it should be used only where the pickup is adequate. Fig. I shows the method. A is the feeder from the aerial, a co-axial cable in this case, as are B and C, the feeders to the respective receivers. The three resisters R are all of equal value and the same as that of the feeder cable, usually 70 to 75 ohms. Ordinary small radio components are quite suitable. If twin feeder instead of

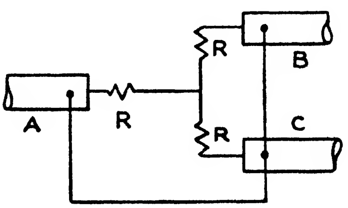


Fig. I.—Method of Feeding Two Receivers from One Aerial.

co-axial is used, the circuit becomes that of Fig. J. The resisters R2 and R3 can then be replaced by additional feeders, enabling four sets to work from one aerial.

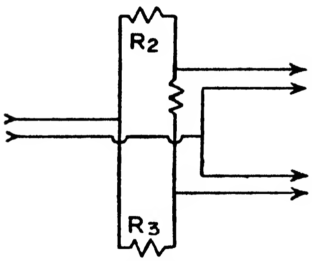


Fig. J.—Modified form of Fig. I for use with Twin Feeder.

Aerial Construction.—The aerials and feeders illustrated in Figs. C and H are Belling Lee products, but many other firms make comparable equipment. For those who would like to experiment, the following data may be of service.

Radio waves travel in metal more slowly than in free space, with the result that an aerial is physically shorter than the nominal wavelength fraction. For any frequency the actual half-wave length in feet (including the centre insulator) is $\frac{470}{F}$ where F is the transmitter frequency in megacycles. If a reflector is fitted, the spacing is normally quarter of the wavelength and the reflector is about 10 per cent. longer than the aerial proper. The reflector is a continuous length of tube secured to the cross-bar by an insulating mounting, and thus without any metallic connection with the rest of the aerial. A quarter-wave aerial is $\frac{470\ F}{2}$ feet long and is not normally used with a reflector.

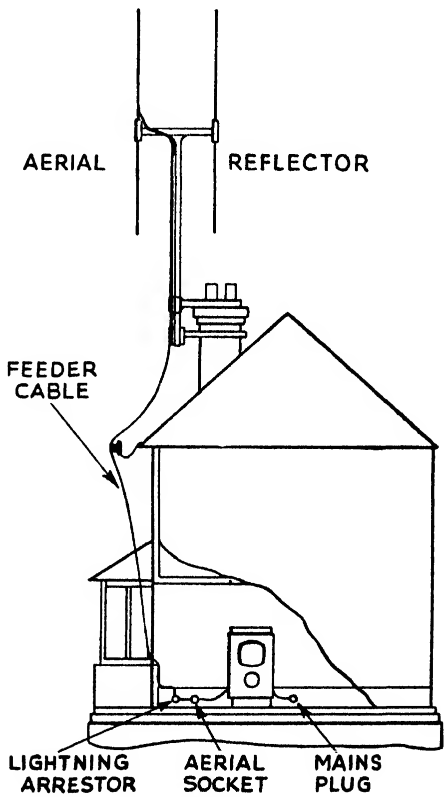


Fig. K.—Complete Television Installation for a House.

Numerous complex forms of aerial are based on these simple types. As the number of elements forming the aerial increases, so does the ability to pick up weak signals and/or the power to discriminate between signal and interference. Complex arrays are, therefore, particularly valuable where the signal strength is poor.

Material for both aerial and reflector can be copper tube as used for plumbing work. The diameter of the tube should be between $\frac{1}{4}$ and 1 in. outside. Small-diameter tube tends to make the aerial rather "sharp," and while this may be a help in the reduction of interference, it tends to spoil picture quality because the full radiation from the transmitter is not

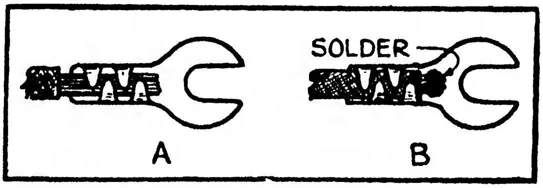
effectively received. For inside aerials working at comparatively short range (10 miles at most) ¼ in. diameter tube is adequate, but an H-type quarter wave needs ½ in. for the aerial and ¾ to 1 in. diameter for the reflector. If the ends of the tubes are fitted with metal closing plugs, they should project as little as possible beyond the tube ends.

Outside aerials must be protected from weather. Inland in residential areas two coats of good bitumen paint are sufficient. Sea air or industrial fumes may prove too corrosive for this protection. In that case the whole aerial may be wrapped (after painting) with a layer of insulating tape. The tape should overlap by half its width, and application must start from the bottom of the aerial or rain will not be excluded.

Fig. K shows a complete television aerial installation, embodying the principles discussed in this article.

WIRELESS AND OTHER CABLE TERMINALS

The use of proper spade terminals instead of loose bare ends of stranded wires is always advisable, although one often comes across bad examples of the joining of cables to spade terminals. Most amateurs make the mistake of soldering or clamping the copper strands only to the spade terminal, thus leaving a neck of wire easily bent and broken. A much better method is to clamp about one-half to two-thirds of the complete cable in the spade terminal, and solder only the tip of the wire as shown at B.



Wireless Cable Terminals.

WIRELESS RECEIVERS, MAINTENANCE AND FAULT LOCATION

Battery Sets.—Although most modern receivers are designed to work efficiently over long periods without troubles occurring, it eventually becomes necessary to attend to certain points in order to maintain the original efficiency of the set. In the case of home-constructed receivers, there is usually more attention required, as the standard of workmanship is not usually so high as with the proprietary make of receiver. If a receiver is moved about frequently, or is in any way exposed to a dusty atmosphere, it will require more attention than otherwise would be the case.

General Maintenance.—It is advisable to go over all the electrical connections and joints, at certain intervals, in order to make sure that they are tight and clean. The aerial and earth connections in particular should frequently be tested in this way.

Test, by attempting to tighten, all nuts and terminals in the set.

Go over the external lead connections to the set, such as the battery leads, making sure that the terminals are tight, and free from corrosive deposits.

The low-tension connections to the battery (or eliminator) should be kept clean, no corroding deposit being allowed to form.

Similarly the " wander-plugs " or common plug and socket on the high-tension connections should be scraped clean and opened out so as to make good electrical connections with the H.T. battery (or eliminator). Whenever there is a split type of plug connection on the set see that the plug makes good contact in its socket.

Unless plugs made good electrical contact, noises may develop in the reproduction, and the set may lose efficiency also. All soldered joints should be examined and tested for breaks by pulling the wires gently.

Dust and Poor Insulation.—One of the most common troubles met with in the care of receivers is that of dust deposit on the insulation of the components and between the blades of the tuning condensers.

This dust definitely reduces the insulation value and tends to cause surface leakage of the high- and low-frequency currents. In the case of the condensers it may actually bridge the plates and lead to a direct loss of efficiency. All insulated surfaces should be kept free from dust, therefore, by using a light brush or duster, taking care not to break any wires. The best method is that of using a vacuum cleaner fitted with a rubber-ended nozzle; this is certainly the quickest method of cleaning condenser plates.

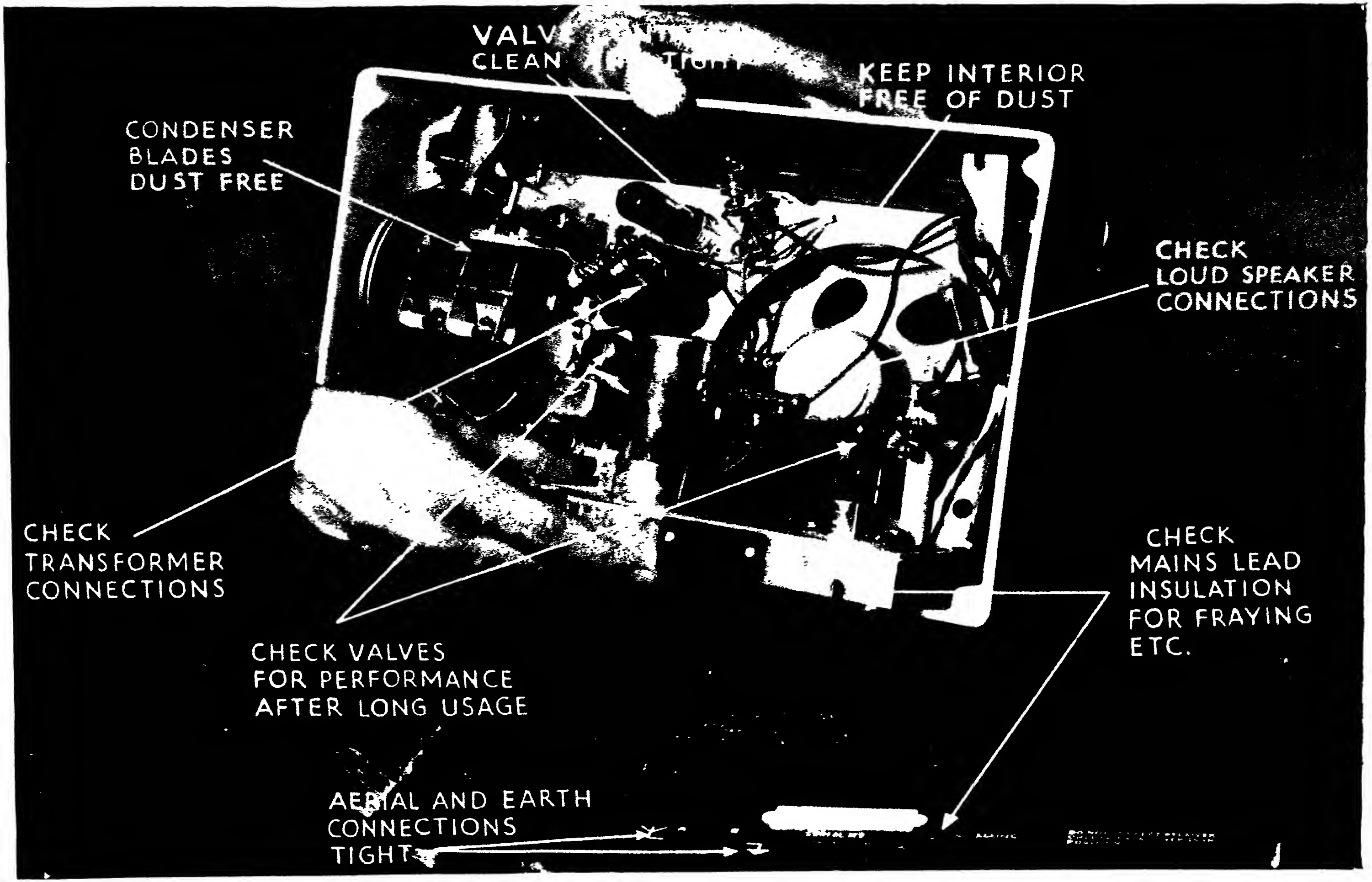
Batteries.—It is hardly necessary, here, to emphasise the importance of keeping the correct battery voltages. For this purpose the batteries should frequently be checked with a voltmeter. A wet battery, such as the L.T. battery, should not be allowed to fall below 2 volts per cell. If it is to be left standing for a few weeks, it should first be charged fully. The grid bias battery usually lasts for at least a year, and on account of its longevity is apt to be forgotten. It should therefore be checked for voltage at regular intervals.

Crackling noises that develop in receivers are usually traceable either to *bad battery connections*, or to a partly *discharged H.T. battery.*

A progressive falling off in volume is usually found to be due to a partly exhausted L.T. battery.

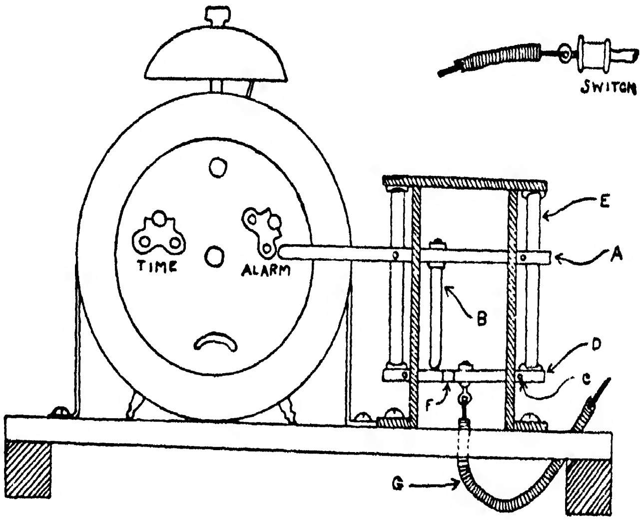
WIRELESS TIME SWITCH

The time switch described can be constructed for a few shillings. The essential thing is a cheap alarm clock which is mounted as in diagram. It is held to the base by a strip of tin, care being taken to see that it is fixed firm. Next the switch release unit, which works on a simple principle, using the clock to release its springs. When the alarm is set to ring at any time, the winding handle starts rotating in the direction opposite to winding, and, as the full power of the spring is exerted on it, it has a powerful thrust, so that it strikes the rod A, causing it to slide horizontally. The latter is of square section to prevent rotation and has bolted to it a pin B which of course has the same movement as A, sliding with it till directly over the hole F in the plunger D. This plunger has a tendency



ILLUSTRATING THE MAINTENANCE OF WIRELESS RECEIVERS

to fly upwards, because of the pull of the springs E in the form of elastic bands, and when released slides up the pin B, thus exerting a powerful pull on the cable attached to an eye in its centre. The cable or wire is part of a length of the well-known Bowden wire control obtainable at any cycle dealer's, and can be of any desired length, being fixed to a push-pull switch as shown in sketch, but of course, it will operate other kinds of switches. The plunger is of a square section and should slide freely in slots cut in the frame, the pins C prevent horizontal movement. Terminate the slot ¼ in. from the rod A, care being taken that this also slides freely and excess movement prevented by pins. See that the rod is adjusted to slide sufficiently far to bring the pin over the hole F, and having once released the switch should be set again, as in sketch. The cable can be conveniently fixed to almost any kind of switch and can be adjusted to switch either on or off. Adjust the alarm wind so that it can rotate freely after having thrust the rod A into position. When the set is required to be switched on at any predetermined time, just set the finger on the small dial on the clock front, and see that the alarm is wound.



Automatic Time Switch for the Wireless Receiver.

SECTION 6

FIRST-AID IN THE HOME

SECTION 6 FIRST-AID IN THE HOME

Accidents will happen—even in the home. In fact, statistics show that an astonishing proportion of mishaps, including many fatal accidents, occur in the house or garden. The risk is obviously increased where there is a home workshop or garage. Any activity involving the use of tools, electricity, or gas, calls for the exercise of due care and intelligence : a few reminders in this connection may not be out of place here, on the principle that prevention is better than cure. A comprehensive list of "don'ts" cannot be given, but some of those that are obvious are worthy of reiteration. For example, never neglect electrical equipment—a shock, especially on a concrete floor, may easily be fatal. Faulty insulation on electric drills, inspection lamps and cables are clearly points to be watched. Similarly gas fittings should be maintained in good condition—gas leaks can also be fatal.

It is, however, in the home workshop that most care should be exercised, especially where there is a power-driven lathe, drill, grinder, or other machine. Most textbooks on wood and metal working stress the importance of "safety-first" measures and it is presupposed that such advice will be followed. Reminders are—do not touch moving machine parts, beware of sharp-edged swarf and turnings, use goggles when grinding tools, clamp work on the drilling machine table instead of holding by hand, hold woodwork in the vice, or down on the bench, when using the chisel, and so on.

There is also another aspect of accidents—after they have happened : in no circumstances should a cut, burn or other injury be neglected. It is absolutely no exaggeration to say that a small cut, left to its own devices, can cause the loss of a limb : blood-poisoning has claimed many victims and it must be remembered that some people are more susceptible to this danger than are others. Again, a cut artery may lead to very serious consequences if prompt attention is not forthcoming.

With most accidents, however, the immediate application of first-aid measures will do much to minimise the damage and ensure a speedy return to normal activity. It must be remembered that first-aid does not constitute medical attention, and should there be the slightest

doubt as to the extent of an injury the family doctor or hospital should be consulted without delay.

BURNS AND SCALDS

Burns may be caused by fire, hot metal or other material, electric current, or strong corrosives, such as vitriol or caustic soda. Scalds are caused by boiling water, steam, or hot oil, etc.

The main danger from burns is the effect of shock; in fact, a child suffering from burns should be treated for shock first, for burns afterwards. The subject of shock will be dealt with subsequently. Another danger lies in inflammation, resulting in septic conditions, while a third complication is the contraction of the scars. In general, the treatment of a burn consists in the exclusion of air, the relief of pain and the prevention or treatment of shock. In the case of a slight burn, this should be dressed and the patient taken to the doctor. For a severe burn the patient should be put to bed and a doctor should be called in : treatment should be given for shock and the burn dressed. Alternatively the patient should be sent immediately to hospital.

On the subject of burns it should be borne in mind that prevention is better than cure. Domestic fires, even those of the gas and electric variety, should be adequately guarded. When brazing or soldering in the workshop keep the tongs handy and watch the whereabouts of the bunsen burner. Keep all corrosive fluids under lock and key and use them with great care. Never use petrol for any purpose whatsoever near a naked light or a lighted cigarette. On the domestic side, never put boiling water into a bath first—always partly fill with cold water first. Handle all heated cooking utensils, especially pans of boiling fat, with discretion : do not leave them where they can be spilled readily.

Burnt Hand.—A slight burn, for example, on the hand, involves little shock and may be treated by the application of a clean dressing made with strips of lint, linen or gauze soaked in a solution of bicarbonate of soda (a dessertspoonful to a pint of warm water) or warm strong tea (the tea-soaked strips should be wrung out and dried). Cotton wool should be placed over the dressing, then a bandage, the arm being supported in a sling. The patient should then be taken to a doctor.

Burnt Thighs.—In the case of severe burns of the thighs, knees and upper part of the legs (as from clothing on fire) send for a doctor or make arrangements for the patient's immediate removal to hospital. Lay the patient flat on his back and treat for shock by keeping him warm with blankets and hot-water bottles. Hot tea or coffee should be given also. Boots and clothing below the waist should be removed, and cut away round any adherence to burns. Dress the burns as described for a slight burn.

Burns of the Face.—The danger here, apart from shock, is in injury to the eyes, and to the mouth and neck, causing inability to breathe.

The dressing in this instance is cut in the form of a two-piece mask: the upper half covers the forehead, cheeks and nose, with holes for the eyes; the lower part covers the cheeks, lips and lower jaw, with a hole for the mouth. Eyelids, nostril edges and lips may be smeared with Vaseline or boric-acid ointment: a drop of castor oil may be put in each eye.

Corrosive Burns.—Acid burns, such as those caused by vitriol, should be flooded with warm water or an alkaline solution made by dissolving a dessertspoonful of washing soda or of bicarbonate of soda, in a pint of water. Alkaline burns (by caustic soda, etc.) should be bathed with water or vinegar and water (equal parts). In both instances the injuries are then treated as burns.

Clothing on Fire.—The patient should lie down, or be laid down, with the flames uppermost and these should be smothered as promptly as possible with water, a rug, coat, etc. Following treatment for shock the burns may then be dressed, as previously described.

Scalds.—In the case of a scalded foot and leg, the patient should be laid down: the boot is then removed and the sock cut away. A dressing is then applied as for a burn, and a doctor should be sent for. In this instance also, any shock must be treated first.

Scalded Throat.—This form of accident is often due to young children drinking from the spout of a kettle, resulting in dangerous swelling at the top of the windpipe. The patient should be put to bed in a warm room and a doctor should be sent for immediately. A towel wrung out in hot water should be applied to the front of the neck from the chin to the upper part of the chest, and sips of cold water should be given, alternatively ice may be given to suck.

ELECTRIC SHOCK

Probably no type of accident is more fraught with danger than that occasioned by electric shock from lighting or power mains. It may be well to reiterate that all electrical equipment must be maintained in good condition if it is to be safe (as well as efficient). Always verify that a line is "dead" before carrying out any repairs to fittings, etc. Never have any type of portable equipment in such a position in the bathroom that it can be touched by anybody in the bath: an electric shock in a bath is almost certain to be fatal. The twin dangers of electric shock are the shock itself, which may result in a cessation of breathing, and extensive burns.

The first part of the immediate treatment is to remove the patient from contact with the source of the electric current. If the relative switch is handy, turn off the current. If not, in the absence of rubber gloves, stand on an insulating substance, such as a folded mackintosh, and push the patient away from contact with the live wire or apparatus with a stick (not metal), holding this in another folded mackintosh or

similar rubber article. The current can be short-circuited, in the case of a bare wire clutched by the patient, by placing one end of a metal rod on the ground and allowing it to fall in contact with the wire on the "supply" side of the patient, i.e. the side nearest the source of electric power.

If breathing stops, or has stopped, apply artificial respiration at once and continue to do so until breathing recommences or a doctor (who should be sent for immediately) advises cessation.

The Schafer method of artificial respiration may be used, in which the patient is laid face downwards with neck clothing loosened and the head turned to one side. The arms are carried forward on either side of the head. The operator should kneel astride or on one side of the patient, placing the hands over the lower part of the back with the thumbs pointing inwards close to the spine.

The operator then leans forward, with arms stiff, pressing steadily and firmly for a count of "one-two." With the hands still in position, pressure is then released by falling back on the heels for a count of "three-four-five."

When breathing has been restored, any burns can be treated as described previously.

Suffocation.—The employment of artificial respiration will also be necessary in other cases where breathing has stopped, as in drowning, accidental strangulation, suffocation by smoke or gases. In these instances a speedy rescue is presupposed; strangulation may require the immediate cutting or removal of any constriction round the neck. It should be remembered that in effecting a rescue from a burning room, the floor is the safest place: a wet handkerchief over the lower part of the face provides an improvised gas mask. Other conditions where it is essential to get the patient into the open air include coal-gas escapes, and where a car engine has been left running in the garage with the doors closed—a dangerous practice that has often led to fatal results.

FIRST-AID EQUIPMENT

Every home should be provided with a first-aid outfit, and the bathroom medicine chest is an appropriate place in which to store it. Ideas vary as to what constitutes a minimum outfit, but the following may be regarded as essentials:

A large triangular bandage, 1 in. finger bandages, 2 in. bandages.
Adhesive plaster, and adhesive plaster dressings, such as Bandaid.
Boric lint and carton of cotton wool, white gauze and linen strips.
Boric powder and ointment.
Vaseline and olive oil.
Bottles of sal-volatile, Friar's balsam and solution of iodine.
Oiled cambric for protection purposes.
Potassium permanganate tablets and Dettol or similar mild antiseptic.
Ammonia, bicarbonate of soda solution.
Nursing (round-nosed) scissors, tweezers, safety pins.

In general, of course, the home medicine chest will contain other items, such as a clinical thermometer, eye bath, and eye lotion, special ointments for various purposes, medicines, etc.; the foregoing list, however, covers most requirements for first-aid in accidents.

Cuts and Abrasions.—Perhaps one of the most common forms of home accident, whether in the workshop or in slicing bread or vegetables, is caused by the slipping of tool or knife, resulting, usually, in a cut hand or wrist. Even the body or a lower limb may be pierced or otherwise injured.

All cuts require prompt and efficient attention but their extent and underlying danger vary considerably. A superficial cut may require only cleansing with a weak solution of antiseptic (required strength is indicated in the makers' directions on the bottle), followed by the application of a Bandaid dressing or one made of lint covered by sticking plaster or a bandage.

Alternatively the cut may be deep, in which event the first consideration will be the arrest of the bleeding. Bleeding or hæmorrhage may be of three kinds : if an artery has been cut, the blood, bright red in colour, will pump out in spurts; blood from a vein will be dark red in colour, and will ooze or flow out of the cut in a slow continuous stream; the third type of bleeding is capillary hæmorrhage in which the blood is red, welling up from all parts of the wound. Without entering too deeply into medical details it is well to remember the above three types of hæmorrhage, as each yields best to its own most suitable treatment. In any event it should be borne in mind that the main idea is to assist Nature's method of stopping hæmorrhage, which is to "clot" the blood, so sealing off the damaged blood vessel. Although injury to a large artery may very quickly prove fatal in the absence of attention, the human body can stand the loss of up to 1½ pints of blood before the position becomes serious—the loss of double that quantity is likely to be fatal.

Arterial Hæmorrhage.—This form of bleeding is dangerous and must be stopped by immediate treatment. The first action is to raise the injured limb, as this makes it more difficult for the heart to pump blood into it. The next step is to apply digital pressure to stop the hæmorrhage at the point of bleeding or on the artery leading to it. The finger, or thumb, used in applying digital pressure on the wound must, of course, be clean, but in any event this method cannot be used where there is glass or other foreign matter in the cut. Digital pressure on the artery is applied at one of the appropriate pressure points as indicated in examples which will be given later.

A second method of stopping the flow of blood is by the application of a pad and bandage to the wound. The pad can be made from a handkerchief or wad of linen and should be of a shape to suit the position of the injury. For example, bleeding from the palm of the hand can be arrested by the application of a piece of lint and a ball-shaped pad held in place by a tight bandage. In fact, a tennis ball can be used as

a pad : the ball is gripped by the patient with the arm raised. For the thigh, to take another example, a pad made from three folded handkerchiefs would be appropriate. The centre of the bandage is placed over the pad and the ends are carried right round the injured limb, being tied in place over the pad.

A third method of applying pressure to stop bleeding is by the use of a pad and flexion, but this cannot be done if the cut limb is fractured also. Bleeding from the hand or forearm can be stopped by placing a pad about the size of a golf ball in front of the elbow. The arm is then "flexed" with the curled fingers touching the shoulder and is secured by a figure-of-eight bandage as shown in Fig. A. A similar method is used, with a pad behind the knee, to arrest bleeding from the leg or foot. In this instance the leg is secured by a figure-of-eight bandage to the thigh (Fig. B).

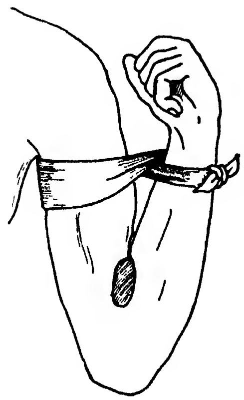


Fig. A.—How to stop Bleeding from Hand or Arm by use of Pad with Flexion of the Limb.

A fourth well-recognised method of stopping arterial hæmorrhage is by the application of a tourniquet. In its simplest form a tourniquet comprises a narrow bandage, tie, strap, a piece of cord or similar band. This is placed round the injured limb on the "heart" side of the wound, and is twisted with a stick, or similar object, to apply pressure, through the flesh, on the artery. The tourniquet may be applied half-way between the elbow and armpit at the upper part of the arm, or in the middle of the thigh. A tourniquet before twisting and after twisting with the stick secured is shown in Fig. C.

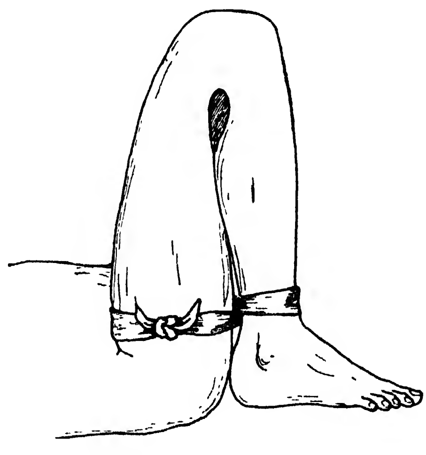


Fig. B.—Method of stopping Bleeding from Foot or Leg by placing Pad behind Knee and using Flexion.

There are, however, certain points that must be borne in mind when using a tourniquet. The limb should always be raised before application of the tourniquet, which must be put on over the clothing or a folded towel, never on the bare skin as its use is painful. Tightening should only be carried out until the bleeding stops : if a tourniquet is applied too tightly a main nerve may be damaged and paralysis may result. Further, if a tourniquet is left on too long blood may not flow into the limb again and the part will become gangrenous and die. Consequently a tourniquet must be loosened after ten or fifteen minutes; it can then be retightened, if bleeding has not stopped, for a further ten minutes, and so on.

Venous and Capillary Hæmorrhage.—Bleeding from a vein is not so difficult to control as arterial hæmorrhage. In general, except where there is a fracture or foreign matter present, digital pressure may

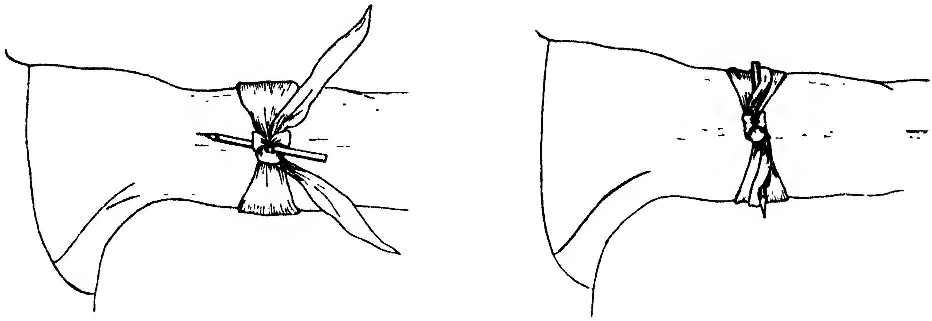


Fig. C.—How to improvise a Tourniquet to stop Flow of Blood through the Brachial Artery. Left Pencil put through Bandage, before twisting. Right, after twisting with Pencil secured.

be applied to the wound. Any tight clothing should be removed from the heart side of the injury to which a pad should be firmly bandaged. Capillary hæmorrhage can be controlled by the direct pressure of a bandage on a dressing over the wound.

Cut Fingers and Hands.—A cut finger presents one of the simplest cases requiring first-aid, although considerable hæmorrhage may occur: this can usually be stopped by pressure on the wound. The next step is to clean around the wound by bathing the skin with water or by the application of iodine. After cleansing, the wound should be covered with a dressing to exclude germs. This may consist of sterilised gauze, lint or linen. The sterilised material is dropped over the wound, covered with cotton wool and bandaged with a finger bandage. Small cuts, after cleansing, may be dressed with a piece of lint held in place by a piece of adhesive strapping or by the application of Bandaid or similar self-fixing dressing.

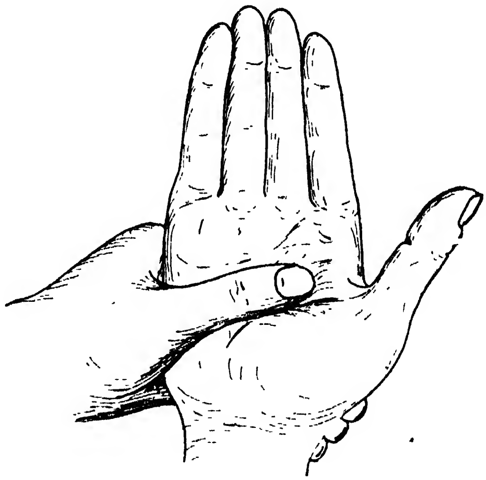


Fig. D.—Applying Pressure to stop Bleeding from Palm of the Hand.

A deep cut in the palm of the hand may result in profuse bleeding. In the absence of any foreign matter in the wound the treatment will consist of pressing the left thumb firmly into the patient's injured palm, squeezing it between the thumb and fingers of the left hand (Fig. D), raising the cut hand as high as possible. Then, with the right hand (or with additional assistance) a ball-shaped pad is made. This is applied,

on top of a dressing, to the wound: the patient's fingers are then bent over the pad, which they should grasp firmly. The patient's clenched fist is then bound up with a narrow bandage as shown in Fig. E. This form of injury will need early medical attention.

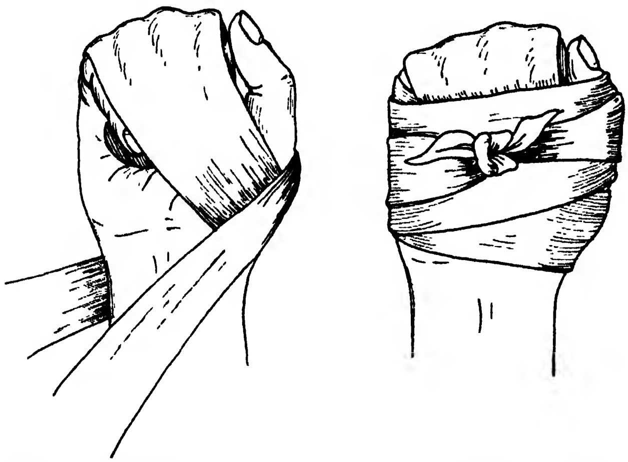


Fig. E.—(Left) Pad held to Wound in Palm by Fingers. (Right) Fingers bandaged to Pad.

Should a foreign body, such as a piece of glass, be in the wound, apply a loose dressing (hæmorrhage is not usually severe in such cases) and seek medical aid at once. If, in the above circumstances, hæmorrhage is severe, digital pressure must be applied at once on the brachial artery in the upper arm (see Fig. F). The procedure is as follows:

The patient's arm is raised at right angles to the trunk with the palm upwards. Then, standing behind him, the middle of the patient's arm is held in the operator's hand, the fingers passing over the front of the arm to the inner side. With the thumb behind, and pressing firmly, the hand is then rotated outwards and backwards.

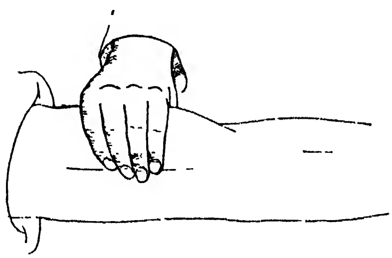


Fig. F.—How to stop Bleeding by Compression of Brachial Artery.

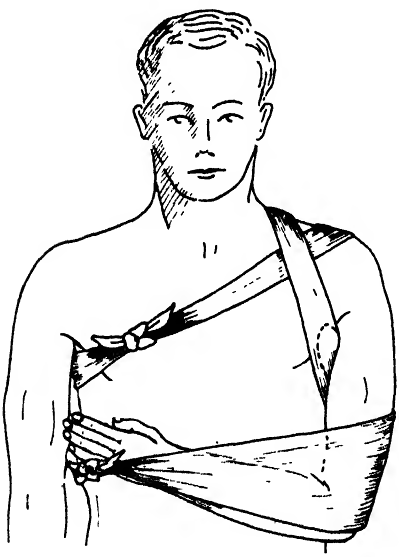


Fig. G.—Method of arresting Hæmorrhage from Arm by Pressure of Pad in the Armpit.

Cut Forearm or Elbow.—Arterial bleeding from a wound in the forearm will be from the radial or ulnar artery and is severe. In this case digital pressure is applied to the wound, followed at once by pressure on the brachial artery as outlined above.

Hæmorrhage from a severely cut elbow is treated by raising the arm and applying digital pressure. Then a pad is applied to the front of the elbow, the arm being flexed and bandaged to the upper arm as in the pad-and-

flexion method of applying pressure to the artery previously described.

Where a cut occurs in the upper arm and bleeding does not stop on direct pressure it will be necessary to apply pressure on the brachial artery, or its continuation, the axillary artery, which lies close to the shoulder joint at the top of the armpit. A large pad in the armpit may stop the flow of blood (see Fig. G).

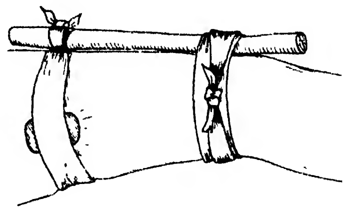


Fig. H.—To stop Severe Bleeding from Thigh. A Stick Tourniquet is used with Pad over Left Femoral Artery. After twisting, the Stick is fixed by a Narrow Bandage above the Knee.

Cut Foot or Leg.—Arterial bleeding from a cut in the foot or leg may be arrested by digital pressure, or the use of a pad and bandage, on the wound. If either of these methods fail the leg may be flexed, as described earlier, with a pad behind the knee. A pad can be improvised by rolling up the trouser leg to the knee. As in the case of a hand or arm wound, the presence of foreign matter in the cut on leg or foot will preclude the use of direct pressure and the leg must be flexed as outlined above.

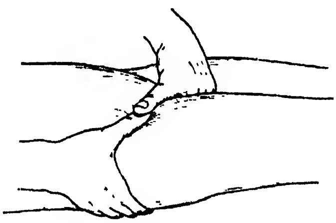


Fig. I.—Thumb Pressure on the Right Femoral Artery to arrest Bleeding from the Thigh.

Cut Thigh.—A cut in the thigh, possibly caused by the slipping of a chisel or other tool, may lead to severe arterial bleeding. This can be stopped by compressing the main (femoral) artery that runs down the inner side of the thigh by the use of a pad and tourniquet (see Fig. H). Remember the precautions necessary in using a tourniquet, as given previously. The hæmorrhage can also be arrested by pressing on the femoral artery where it passes over the haunch bone, in the centre of the groin. Pressure is applied by both thumbs, one over the other, as shown in Fig. I.

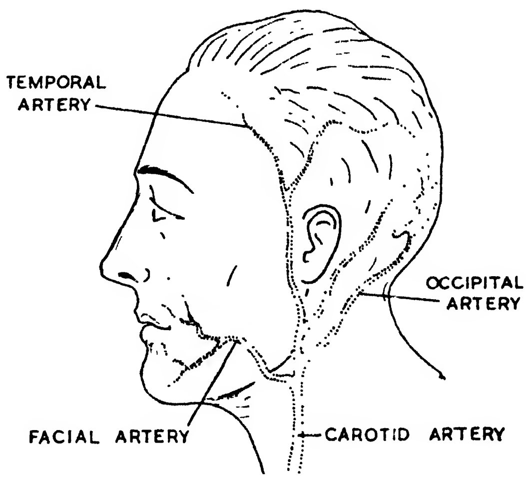


Fig. J.—Head Arteries.

Head and Neck Injuries.—If bleeding from injuries in the head or neck does not stop on the application of direct pressure, the main artery leading towards the wound must be compressed. The four main head arteries (see Fig. J) and their pressure points are as follows

The *carotid* artery lies on either side of the neck and pressure is

applied by the thumb, inwards and backwards against the spine below the Adam's apple (Fig. K). The right thumb is used against the patient's left carotid and *vice versa.*

The *facial* artery supplies blood to the face below the eye and pressure may be applied 1 in. in front of the angle of the lower jaw (see Fig. L).

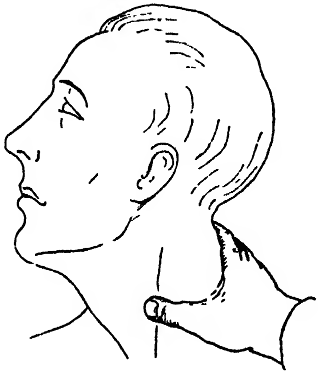


Fig. K.—Applying Pressure on the Left Carotid Artery.

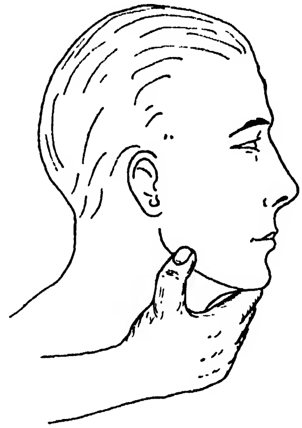


Fig. L.—How to apply Pressure on the Facial Artery to stop the Flow of Blood to the Face below the Eye.

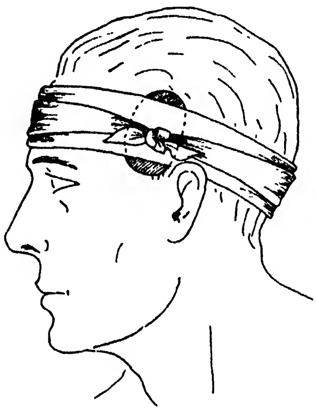


Fig. M.—Bandage on Pad over Pressure Point of Temporal Artery to arrest Severe Hæmorrhage from Side of Head.

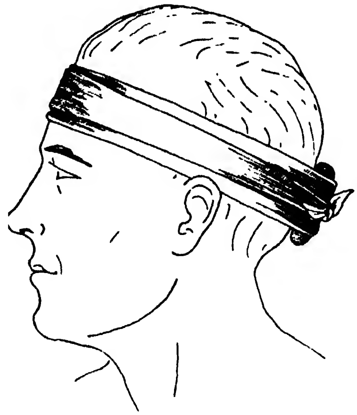


Fig. N.—Pad and Bandage to Stop Bleeding from the Back of the Scalp.

The *temporal* artery branches out from the upper end of the carotid above the ear. Severe hæmorrhage from this artery is treated by digital compression on the wound or pressure on the artery 1 in. in front of the ear opening and just above that point. A pad, about 2 in. diameter, is bandaged over the wound : a narrow bandage is used and this is carried twice round the head with the knot over the pad (see Fig. M).

The fourth important head artery is the *occipital*, branching out from the carotid on either side of the head, towards the back. The pressure point for the occipital artery, on either side, is where the neck and head join, at a spot four fingers-breadth behind the rim of the ear. The pad intended to cover a wound at the back of the scalp is bandaged round the head, the bandage being twisted over the forehead and taken back with a knot over the pad (Fig. N). The bandage for a pad on top of the head is carried round under the chin.

Severe Scalp Wounds.—Extensive injuries to the scalp or those associated with fracture of the skull, or where the patient is unconscious, are treated by the use of a ring pad made from a large handkerchief. The handkerchief, or a triangular bandage, is folded into a narrow strip and this is wound round the left hand to form a loop. About two feet of the free end of the bandage is then wound round the loop to make a ring (see Fig. O). The wound is surrounded by the ring, but is not subjected to pressure when the pad is bandaged in position. The effect is to apply pressure *around* the wound, not *on* it.

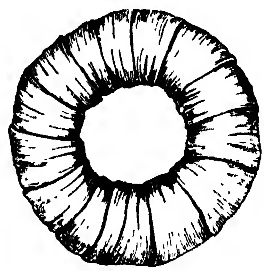


Fig. O.—Ring Pad made from Triangular Bandage or Large Handkerchief.

FRACTURES, SPRAINS, AND STRAINS

Accidents, usually caused by a fall, involving the fracture of bones or damage to muscles or tendons cannot be ruled out either in house or garden and in all cases prompt first-aid will ease pain and prevent additional injury. All fractures must, of course, be treated at the earliest possible moment by a doctor.

Fractures are of three main types: simple, compound, and complicated. A simple fracture is one in which the broken ends of the bone are not exposed. With a compound fracture there is a wound over the break leading down to the bone ends or fragments; alternatively these may protrude through the skin. A complicated fracture involves the tearing of soft parts, injuries to important blood vessels or nerves, or dislocation of the fractured bone: a broken rib that pierces the lung is an example of a complicated fracture. Each type of fracture demands its appropriate treatment, and it is well to remember that a carelessly handled simple fracture may become compound or even complicated. A fracture will be recognised by pain, loss of power in the limb, deformity or swelling, or by the limb assuming an unnatural position.

The main function of first-aid in the case of fractures is to prevent further damage and to make the patient as comfortable as possible, pending expert medical attention. To achieve both purposes the injured limb is secured with splints and bandages. Any hæmorrhage must be dealt with before the fracture is put in splints, unless the bleeding is of a trivial nature.

Fractured Spine.—A broken spine, either in the lower part of the neck, or in the small of the back, results in shock and paralysis; in the former case, of the arms, body and legs, with loss of feeling below the shoulders. In the latter case there is paralysis of the legs with loss of feeling up to the level of the navel. The fracture may be caused by a fall from a height on to the head, or a fall across some fixed object. An injury of this nature, occurring at home, is best treated by covering up the patient and warning him to lie still. Every effort should be made to get a doctor immediately.

Fractured Pelvis.—This type of injury may also be caused by a fall, the signs being a large bruise, inability to stand without pain, or to move the legs freely, and pain on pressing the sides of the pelvis. The patient should be placed in the most comfortable position, preferably flat on the back with the legs straight. A broad bandage, such as a towel, may be placed in the hollow of the back and worked down round the pelvis.

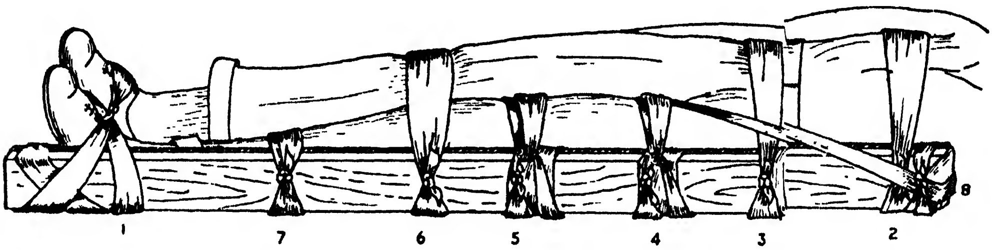


Fig. P.—Fractured Left Thigh with Splint applied over Clothing. Numbered Bandages are referred to in the text.

The towel is then stretched and carried round to the front of the body and fixed firmly, but comfortably, in position. In this instance also a doctor should be called at once.

Fractured Thigh (Femur).—This injury may be caused by a fall from a height, from a ladder for example, and can be recognised by deformity of the limb, which may also be in an unnatural position with the knee turned outwards and the foot rolled out. Here again may be swelling, discoloration and shortening of the limb.

In this instance also the doctor should be sent for immediately and the patient should be kept warm. Where there is the possibility of delay in obtaining medical attention, the injured leg should be tied to the other by handkerchiefs or bandages at the top of the thighs, above the knees, below the knees and round the ankles and feet.

Where available, a splint makes a better job (see Fig. P). The splint is preferably a piece of wood 4 in. by $\frac{1}{2}$ in. reaching from the armpit to beyond the heel. Improvised splints can be made from broom handles, walking sticks, billiard cues, etc.

With the patient flat on his back, the limb, if much shorter (say 2 in.) than the sound leg, should be drawn down gently by the ankle to align

ment with the latter. The splint is laid, with padding between it and the limb, along the outside of the injured leg. A second splint may be placed inside the broken limb, extending from the groin to the heel. Alternatively the two legs may subsequently be tied together in lieu of the second splint.

The splint is secured with eight bandages. The first is used to bind the splint to the foot and ankle, the second holds the splint to the chest, the third is round the pelvis, the fourth binds the splint (or splints) to the thigh above the fracture. The fifth bandage binds the splint to the thigh below the fracture. Both knees and the splint are secured by the sixth bandage, the leg is held to the splint by the seventh, while the eighth lies obliquely round the groin and is attached to the top of the splint. The injured leg should not be lifted while being put in splints and all knots are tied on the outer sides of the splints.

Fractured Knee-cap (Patella).—This injury may be caused by a slip or fall, resulting in pain and inability to straighten the leg: the knee will be bruised and swollen and a gap may be felt between the broken portions of the knee-cap.

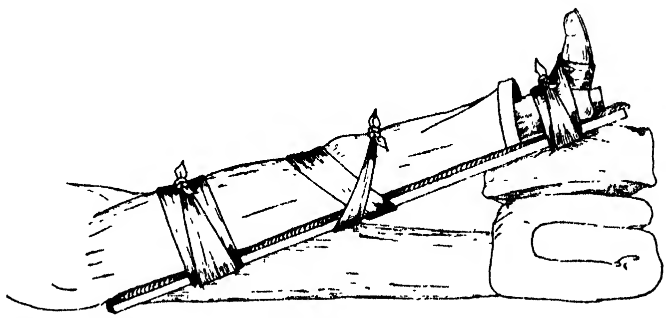


Fig. Q.—How to treat a Fractured Knee-cap, with Splint below Limb and Foot supported on cushion.

The patient should be laid on his back with the head and shoulders supported by a pillow. The limb should be straightened and raised through half a right angle, with the foot supported after splinting. The splint is applied along the back of the leg from the hollow behind the hip to beyond the foot and is tied at the ankle, the bandage also passing round the instep. A broad bandage secures the splint to the thigh. A narrow bandage is placed with its centre just above the knee-cap, the ends being carried round below the splint and then back to a point below the knee where they are tied (see Fig. Q). Ice or cold-water dressings are applied over the knee.

Fractured Leg.—A fracture of the leg may involve one or both bones, the large "tibia" or the smaller "fibula." When both bones are fractured there is the usual shortening of the limb and other signs of fracture, as outlined in the case of the thigh. When one bone only is broken there is no shortening of the leg. In accidents caused by the foot slipping and turning under, the fibula may be broken 2 in. or so above the ankle joint. This is known as "Pott's fracture," and the foot appears twisted outwards with the heel prominent: no weight can be borne on the foot.

In cases where leg bones are broken, steady the limb by holding ankle

and foot and, in the absence of splints, tie the knees, legs and feet firmly together. A cushion may be bandaged behind the leg.

Splints of wood, sticks, etc., may be applied to the outer and inner sides of the leg, from above the knee to beyond the foot (see Fig. R). Five bandages are used, the first to secure the splint to the foot; the second holds the splint to the thigh above the knee; the third and fourth encircle the leg and splint above and below the fracture, while the fifth is used to bind both knees and splints. The legs may also be tied together lower down, but it is important that no bandage be put over the seat of the injury; no splint must be put down the front of the leg.

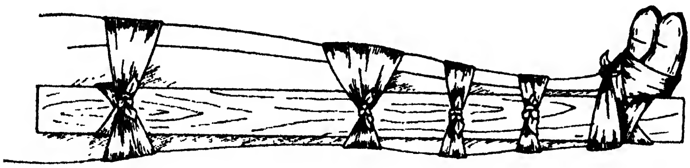


Fig. R.—Treatment for Broken Leg, using Splint, and binding Both Legs together.

Compound Fracture of Tibia or Large Leg Bone.—This injury is easily recognised by pain in the leg, inability to move the foot and deformity of the middle of the leg with a wound in front from which an end of the bone may be protruding.

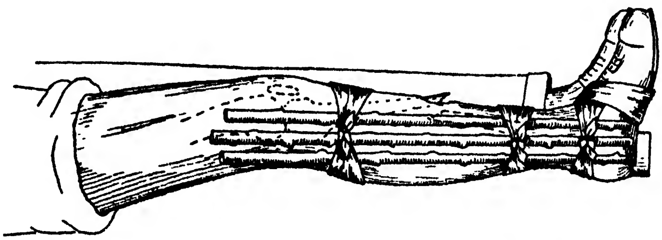


Fig. S.—How to deal with a Compound Fracture of the Tibia. Note Protruding End of Bone. Method shown in Fig. R is preferable if Splint is Available. Improvised Stick Splint is shown here as Alternative.

In this instance, as with all fractures, a doctor should be sent for at once and arrangements made for transfer of the patient to hospital as soon as possible. Immediate first-aid treatment consists of cutting the clothing and applying a dressing to the wound. The limb should be steadied, the foot being pulled out straight, followed by splinting the leg on the outer side, bandaging above and below the wound and round the foot (Fig. S).

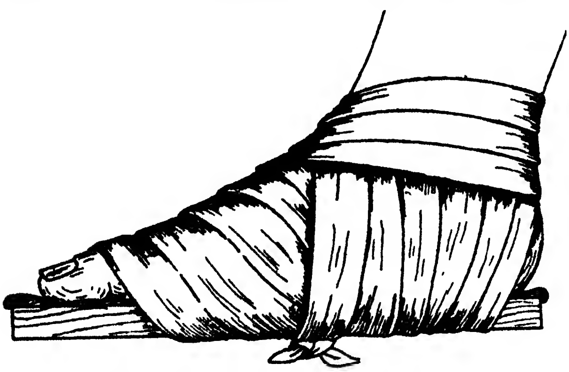


Fig. T.—Splint bandaged to Sole of Foot.

Fracture of the Foot.—A fall from a height may cause this injury, which can be recognised by pain, swelling and loss of power. The boot is carefully removed, cutting if necessary, and a padded splint

is applied to the sole of the foot. This splint is bandaged to the foot, and the ends pass round the ankle, with the knot tied over the splint on the sole (Fig. T).

Fractured Collar-bone (Clavicle).—The breaking of the collar-bone may be caused by a fall on the shoulder or outstretched hand, and is recognisable by a partial helplessness of the arm on the injured side : the broken ends of the bone can generally be felt and these may overlap. Treatment consists in placing a large pad in the armpit and

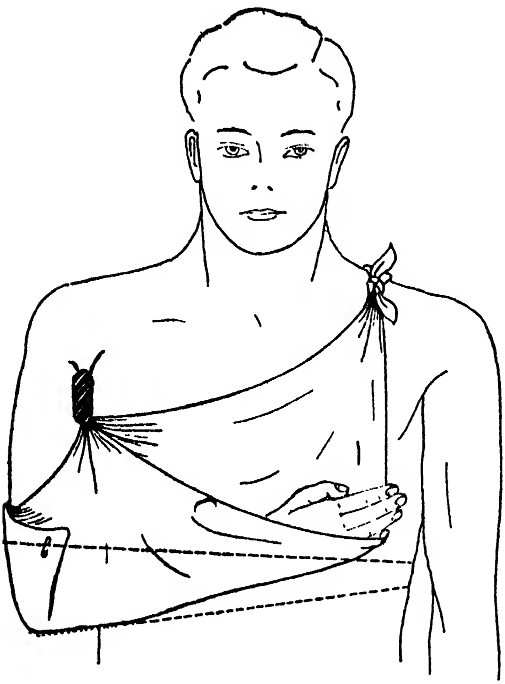


Fig. U.—Treatment for Fracture of Right Collar-bone, with Pad under the Armpit and Arm in Sling.

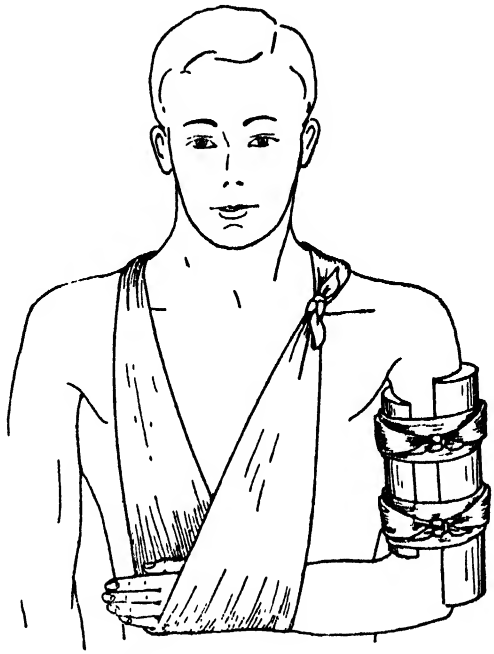


Fig. V.—Use of Splints and Sling in Treatment of Fractured Arm.

stretching out the broken collar-bone by bandaging the upper arm and elbow to the body. The forearm is supported in a sling with the fingers pointing slightly upward (see Fig. U).

Fractured Arm.—To treat a fractured upper arm (humerus) the patient should be seated and clothing removed from the injured limb. The forearm is supported at a right angle to the arm and four small pieces of wood, reaching from shoulder to elbow, are padded for use as splints. These are applied to the back, front, and side of the arm, and are secured by narrow bandages above and below the fracture. The hand and wrist are supported in a sling (see Fig. V). In the absence of splints, secure the arm to the side of the body, using two broad bandages. For a fracture near the elbow joint use a splint made from two pieces of wood bound together in the form of an L.

Fractured Forearm.—A fracture of the forearm is usually caused by a blow or a fall, and is frequently due to a "back-fire" when starting a car. (Do not put the thumb round the handle when cranking up.) When the tip of the elbow is fractured, denoted by swelling, discoloration, and pain at the back of the elbow, apply a splint, reaching from the middle of the arm to the wrist, along the front of the forearm and arm.

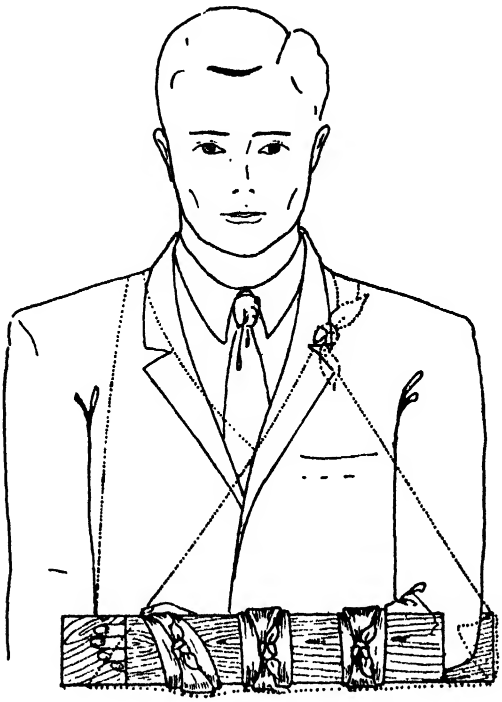


Fig. W.—How to apply Double Splints to Broken Forearm.

When both bones of the forearm are fractured, the elbow should be bent to a right angle, with the thumb upwards and the palm of the hand against the body. Two padded splints are applied; one, extending from beyond the elbow to the knuckles, is placed on the back of the forearm. The other splint reaches from the elbow to beyond the finger tips, along the palm of the hand. Three bandages are used, above and below the fracture, with the third round the hand below the thumb (Fig. W). The arm is then supported in a large sling. Similar treatment is given for a fractured wrist.

A fractured hand may be splinted by a piece of wood about 8 in. long and 3 in. or so wide (Fig. X). A narrow bandage is used to secure the splint to the palm of the hand, which is then rested in a sling.

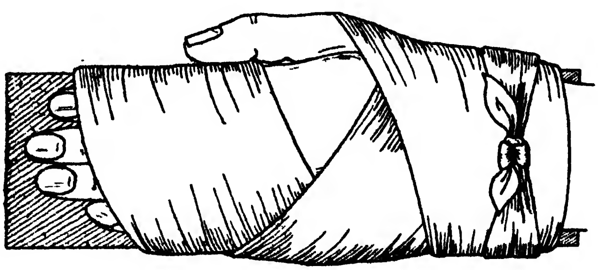


Fig. X.—Palm of Hand bandaged to Splint where Hand Bones are broken.

Broken Ribs.—Great care must be exercised in dealing with fractured ribs, due to a fall or crushing, since there may be injuries to an internal organ. Such injuries may result in internal hæmorrhage giving rise to such signs as pallor, thirst, rapid pulse, with breathlessness and pain in the chest. The piercing of a lung by a broken rib will be indicated by the coughing up of frothy bright-red blood.

In these circumstances the patient is laid down, inclined towards the

injured side. Clothing should be loosened and a cold-water compress may be placed over the injury. In all cases send at once for a doctor.

In less severe cases, where there is no sign of internal injury, two broad bandages, overlapping, may be placed round the chest. Each of the bandages is tied on the sound side of the chest as the patient exhales: they are intended to relieve the pain on breathing (see Fig. Y). The arm on the injured side is placed in a large sling. A folded towel, about 10 in. wide, secured by safety pins, may be used instead of bandages.

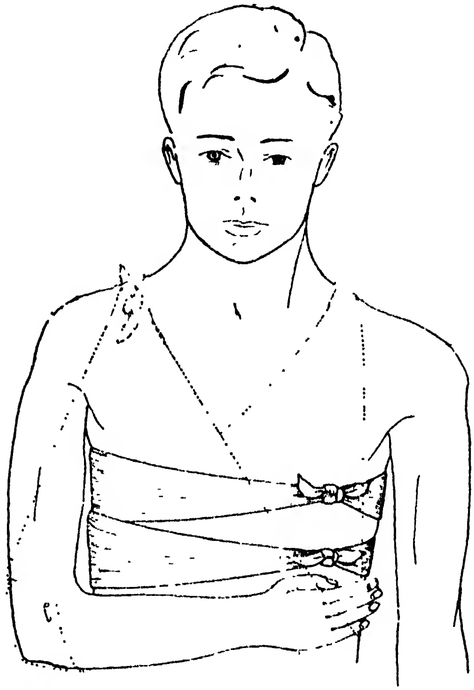


Fig. Y.—Bandages for Broken Ribs; Arm Sling shown by Dotted Lines.

Fracture of the Skull.—This type of injury is recognisable by concussion, with relaxed limbs, weak pulse, bleeding from the ears and, except in fractures of the base of the skull, injury to the scalp. The patient should be laid flat and wrapped in warm blankets: any head wound should be dressed and the case should be taken to a doctor or hospital immediately.

Fracture of the Lower Jaw (Mandible).—This fracture is caused by a direct blow, resulting in pain on moving the jaw, possibly loose teeth, bleeding from the gums and difficulty in swallowing. The mouth should be closed gently, the lower jaw being held up by a narrow bandage passed under the chin and over the top of the head. One end is left long, and this is passed round the front of the chin to the back of the head where it is tied to the other end of the bandage (Fig. Z).

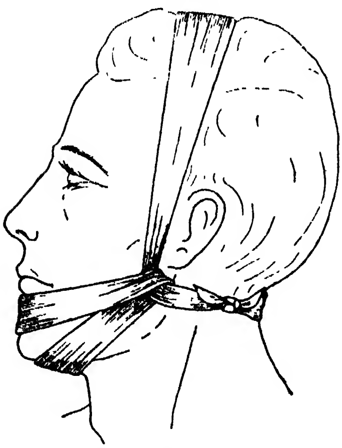


Fig. Z.—Single Narrow Bandage used for Fractured Lower Jaw.

POISONING

The general treatment for poisoning is the administration of an emetic except when the patient cannot swallow or is unconscious, or where there are stains or burns round the mouth or lips.

The emetic may take the form of tickling the back of the throat with a finger, feather, or similar object. Another emetic consists in drinking

half a tumbler of warm water in which a dessertspoonful of mustard has been stirred. Alternatives are two tablespoonsful of salt dissolved in a minimum quantity of water, and repeated doses of ipecacuanha wine (two teaspoonsful) every five minutes.

A further remedy is the administration of an antidote: for acids use a tablespoonful of magnesia in water, or one to two tablespoonsful of chalk or whiting, mixed with water. For alkaline poisoning, administer two to three tablespoonsful of vinegar or lime juice in water. Where the nature of the poison is unknown it is safe to give milk, raw eggs beaten up in water, olive oil (except where phosphorus poisoning is suspected) and strong tea.

In cases of poisoning, shock will require the giving of stimulants and the application of warmth. Weak breathing may have to be assisted by artificial respiration. In cases of drowsiness the patient should be kept moving: pain may be relieved by a hot fomentation over the stomach.

Eye Injuries.—Except in cases where a foreign body can be seen just inside either lid, make no attempt to remove it. It is preferable to apply two or three eye drops (·5 per cent. cocaine in mercuric chloride in castor oil, 1 in 3,000, supplied by a chemist). The eye should then be covered with an eye shade, and a doctor must be consulted at once.

Bruises.—A bruise may be caused by a fall or a blow from a hammer or similar tool. The signs are swelling, with subsequent discoloration, and considerable pain. A bandage soaked in cold water is helpful. Alternatively a handkerchief or piece of cotton wool may be soaked in a solution consisting of a tablespoonful of methylated spirit in a tumbler of cold water. The application should be changed every four hours, and the affected part should be rested.

SHOCK

Shock is a condition of collapse or prostration caused by burns, fractures, severe cuts or wounds, and the symptoms are faintness, pallor, clamminess of the skin, shallow respiration, rapid and feeble pulse, and, when much blood has been lost, considerable restlessness. Preventive treatment, which is of great importance, rests in the speedy removal of the patient from the scene of injury and then sending for a doctor. Also, where a bad cut is bleeding profusely and is liable to cause shock, the hæmorrhage should be dealt with first. It has already been pointed out, however, that a badly burnt child should be treated to combat shock before the burns are dressed.

The patient should be laid down with clothing loosened but not removed. He should be warmly wrapped up and given hot tea or coffee to drink, if he is conscious and there is no pain in the stomach.

When shock has arisen, medical assistance should be expedited, hæmorrhage should be treated at once and additional means should be adopted to keep the patient warm. In the absence of fracture, the legs may be raised on cushions above the level of the body. Remember

that shock drives the blood away from the surface of the body—the above measures are designed to bring it back.

The foregoing is intended to give, in brief outline, the appropriate first-aid treatment for the more serious types of mishap in the home, where such assistance may make all the difference between permanent disablement or even a fatal outcome of the accident. It will be appreciated, however, that to do the right thing at the right time, without having to refer to a book for guidance step by step, requires a certain amount of practice and study, so that a really useful knowledge of first-aid may be acquired. In this connection the perusal of the excellent handbooks issued by such bodies as the British Red Cross Society and the St. John Ambulance Brigade is strongly advised. Finally, it will be found that attendance at a properly organised first-aid class will provide the the practice that "makes perfect," and may prove of inestimable value in an emergency.